

MEDH/111/25/03/24

For II yr onwards

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

Dr. H. B.
14/12/21

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Department of Mechanical Engineering

**BOARD OF STUDIES (BOS) PROCEEDING
DEPARTMENT OF MECHANICAL ENGINEERING
(MEETING DATED 30th May 2024)**

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MINUTES OF MEETING OF BOARD OF STUDIES (BoS)

An online meeting of following members (external and internal) was held on 30th May 2024 at 12:00 noon through online mode (Google Meet Link <https://meet.google.com/oia-qvod-gmv>).

Following members were present:

- | | | |
|------|-----------------------------|---|
| (1) | Dr. M.K. Gaur | Head of the Department and Chairman of the Committee |
| (2) | Dr. Prashant Kumar Jain | Professor, IITDM, Jabalpur, RGPV Nominee |
| (3) | Dr. Mukul Shukla | Professor, MNNIT, Allahabad, AC Nominee |
| (4) | Er. Abhishek Khare | Aerodynamics Engineer Calidus, LLC, Abu Dhabi, Alumni |
| (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. Gavendra Norkey | Member |
| (18) | Vansh Vandhe | Student Member, II Year |
| (19) | Deepak Singh | Student Member, III year |
| (20) | Anshita Verma | Student Member, III Year |
| (21) | Piyush Soni | Student Member, IV Year |
| (22) | Alok Sharma | Student Member, IV Year |

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Instructions for preparing BoS Proceedings

[All information is to be uploaded on the webpage under suitable heading (such as Board of Studies) and separate links to be provided for each category mentioned below]

Minutes should have a summary/cover page mentioning all the significant changes made in the following Given format

Courses 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
NIL							

Courses focusing on employability/entrepreneurship/ skill development					
(Course/subject name)	Course Code	Activities/contents which have a bearing on increasing skill and employability	Agenda Item No.	Page No.	Link of relevant documents/minutes
Metrology, Measurement and Control	120732	Advanced measurement tools.	ITEM ME4	31	https://drive.google.com/file/d/1bD_ApwMcPZTaM_kJLep0F15gzQqC9YgWk/view?usp=sharing
Hybrid Electric Vehicles	190732	Concept of electric concept in vehicles.	ITEM ME4	38	
Automotive Maintenance Lab	190715	Hands on practice on vehicle maintenance.	ITEM ME6	45	
Reliability and Vibration Lab	120715	Fault detection in bearings and remedies	ITEM ME6	46	
Foundation of Computational Fluid Dynamics	120761	Analysis of fluid flow through simulation.	ITEM ME3	16	
Advanced Machining Processes	120763	Latest machining processes and their application.	ITEM ME3	19	
Fundamentals of Additive Manufacturing Technologies	120764	Additive manufacturing concepts with applications.	ITEM ME3	20	
Aluminium based Alloys and Metal Matrix Composites	190765	New materials used for automotive structures.	ITEM ME3	27	

New Courses added					
(Course/subject name)	Course Code	Activities/contents which have a bearing on increasing skill and employability	Agenda Item No.	Page No.	Link of relevant documents/minutes
Aluminium based Alloys and Metal Matrix Composites	190765	New materials used for automotive structures.	ITEM ME3	27	https://drive.google.com/file/d/1gcJiSgoTrxuUYAb904ABH14I8mDaYSYxp/view?usp=sharing

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Feedback on curriculum received from stakeholders: Analysis & ATR*

Stakeholder	Student	Faculty	Alumni	Employer
No. of responses	150	10	30	67
Link of Analysis	https://docs.google.com/document/d/1cRYrb3UNZmdvR1AKVUB064iRfD1nLfedit?usp=drive_link&ouid=110499483831438724131&rtoref=true&sd=true	https://docs.google.com/document/d/1cRYrb3UNZmdvR1AKVUB064iRfD1nLfedit?usp=drive_link&ouid=110499483831438724131&rtoref=true&sd=true	https://docs.google.com/document/d/1cRYrb3UNZmdvR1AKVUB064iRfD1nLfedit?usp=drive_link&ouid=110499483831438724131&rtoref=true&sd=true	https://docs.google.com/document/d/1cRYrb3UNZmdvR1AKVUB064iRfD1nLfedit?usp=drive_link&ouid=110499483831438724131&rtoref=true&sd=true
ATR Link	https://docs.google.com/document/d/1cRYrb3UNZmdvR1AKVUB064iRfD1nLfedit?usp=drive_link&ouid=110499483831438724131&rtoref=true&sd=true	https://docs.google.com/document/d/1cRYrb3UNZmdvR1AKVUB064iRfD1nLfedit?usp=drive_link&ouid=110499483831438724131&rtoref=true&sd=true	https://docs.google.com/document/d/1cRYrb3UNZmdvR1AKVUB064iRfD1nLfedit?usp=drive_link&ouid=110499483831438724131&rtoref=true&sd=true	https://docs.google.com/document/d/1cRYrb3UNZmdvR1AKVUB064iRfD1nLfedit?usp=drive_link&ouid=110499483831438724131&rtoref=true&sd=true
Link showing Excel sheet of Google Form details of stakeholders	https://docs.google.com/spreadsheets/d/1S2NBM0_oqbB46bcTX7EUB0jPgB3eGP2C/edit?usp=drive_link&ouid=110499483831438724131&rtoref=true&sd=true	https://docs.google.com/spreadsheets/d/16gYb2szPR7FjkRyICCCQGbLw8VbGWSZ/edit?usp=sharing&ouid=110499483831438724131&rtoref=true&sd=true	https://docs.google.com/spreadsheets/d/1VlIXjA_FK8dY4WTqHdUsNqhuAAuFJGFy/edit?usp=drive_link&ouid=110499483831438724131&rtoref=true&sd=true	https://docs.google.com/spreadsheets/d/1KRFXk_dHWKpyd1TKrpgcRnqjQRxFAHAA/edit?usp=drive_link&ouid=110499483831438724131&rtoref=true&sd=true

* Separate page(s) for each of the above four points; Agenda point wise minutes to be appended with each point and a separate link to be given in the appropriate column for each point

The BoS minutes along with the cover/summary page (under point number 1, above) must be uploaded on the departmental web page and link for the same must be shared with the office of the Dean Academics.

Stakeholder feedback analysis must also contain an action taken report (ATR).
The details/data of the stakeholder responded through GOOGLE form (such as Name, organization, mail id, phone no if available) must also be shared along with the feedback for the alumni/employer.

The following must be uploaded on the departmental web page and link for the same must be shared with the office of the Dean Academics.

- The Stakeholder feedback collected & analyzed to find the index out of five
- Action taken report
- Google form showing responses from alumni, employer, student, faculty etc.

Minutes should have a footer with department name, page number, month of meeting.

Each page should be signed by all faculty, scanned and then submitted to the Dean Academics office.



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Agenda of the BoS Meeting

BoS Agenda Items

Item
ME1

To confirm the minutes of previous BoS meeting held in the month of December 2023

The minutes of the last BoS held on 1st December 2023 were confirmed. The BoS Minutes were presented & approved in Academic Council Meeting held on 14th December 2023.

Item
ME2

To review and finalize the scheme structure of B.Tech. VII Semester with the provision of Three (03) Departmental Electives (DEs) and Open Category (OC) Course. (Out of which One (01) Elective and of Open category course is to be offered in traditional mode and remaining Two (02) Departmental Electives are to be offered in online mode with credit transfer for the batch admitted in 2021-22.

S.No.	Subject Code	Category	Subject Name & Title
1.	DE	DE	Departmental Elective-2 (DE-2)
2.	DE*	DE	Departmental Elective -3 (DE-3)
3.	DE*	DE	Departmental Elective -4 (DE-4)
4.	OC	OC	Open Category -2 (OC-2)
5.	190715/120715	DLC	Automotive Maintenance Lab/Reliability and Vibration Lab (DLC-6)
6.	190716/120716	DLC	Summer Internship Project-III (Institute Level) (Evaluation)
7.	190717/120717	DLC	Creative Problem Solving (DLC-7)

Item
ME3

To propose the list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in online mode for Two (02) Departmental Electives (DE) Course, with credit transfer in the B.Tech. VII Semester under the flexible curriculum (Batch admitted in 2021-22).

Mechanical Engineering			Automobile Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	120761 DE-3	Foundation of Computational Fluid Dynamics	1	190761 DE-3	Farm Machinery
2	120762 DE-3	Introduction to Composites	2	190762 DE-3	Introduction to Mechanical Vibration
3	120763 DE-3	Advanced Machining Processes	3	190764 DE-4	Sustainable Power Generation Systems
4	120764 DE-4	Fundamentals of Additive Manufacturing Technologies	4	190765 DE-4	Aluminium based Alloys and Metal Matrix Composites
5	120765 DE-4	Energy Conservation And Waste Heat Recovery			
6	120766 DE-4	Work system Design			

Item
ME4

To prepare and finalize the syllabus of courses to be offered (for batch admitted in 2021-22) 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	120732	Metrology, Measurement and Control	1	190731	Vehicle Dynamics
2	120733	Total Quality Management	2	190732	Hybrid Electric Vehicles
3	120734	Turbo Machinery			

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Item
ME5

To prepare and finalize the syllabus of courses to be offered (for batch admitted in 2021-22) 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)		
S.No.	Subject Code	Subject Name
1	910208	Solar Energy
2	910209	Maintenance Engineering

Item
ME6

To review and finalize the Experiment list/ Lab manual for Departmental Laboratory Course (DLC) to be offered in B. Tech. VII semester (for batches admitted in 2021-22).

Automotive Maintenance (190715)	Reliability and Vibration Lab (120715)
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.

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 2021-22) and for B.Tech. V semester (for the batch admitted in 2022-23)

Sem	V (for the batch admitted in 2022-23)	VII (for the batch Admitted in 2021-22)
Minor Course Name	1. Materials Processing (Casting, Forming and Welding) (12 Weeks) 2. Fluid Mechanics (12 Weeks)	1. Engineering Metrology (12 Weeks) 2. Applied Thermodynamics for Engineers (12 Weeks)

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Honour V & VII sem Track						
Sr No	Design Track		Thermal Track		Production Track	
	Honors (Jan.-June)	Honors (July-Dec.)	Honors (Jan.-June)	Honors (July-Dec.)	Honors (Jan.-June)	Honors (July-Dec.)
1	Design, Technology and Innovation(8 week)	Advanced Materials and Processes (12 week)	Computational Fluid Dynamics for Incompressible Flows(12 Weeks)	Power Plant Engineering (8week)	Introduction To Mechanical Macro Machining(8 weeks)	Fundamentals of manufacturing processes (12 week)
2	Experimental Stress Analysis(12 weeks)	Engineering Fracture Mechanics (12 week)	Turbulent Combustion: Theory And Modeling (12 weeks)	Advanced Thermodynamics and Combustion (12 week)	Product Design and Manufacturing(12 weeks)	Rapid Manufacturing (12 week)
3	Robotics: Basics and Selected Advanced Concepts(8 weeks)	Introduction To Composites (12 week)	Experimental Methods in Fluid Mechanics (12 Weeks)	Applied Computational Fluid Dynamics (12 week)	Mechanics of Fiber Reinforced Polymer Composite Structures(12 weeks)	Fundamentals of Additive Manufacturing Technologies (12 week)
4	Modeling and Simulation of Dynamic Systems(8 Weeks)	Solid Mechanics (12 week)	Heat Transfer and Combustion in Multiphase Systems(8 Weeks)	Fundamentals of Convective Heat Transfer (12 week)	Fundamentals Of Electronic Materials And Devices (8 weeks)	Automation in Manufacturing (12 week)

Added in welding and Joining Technology (8 week)
Metallurgical and Section waste Recycling (8 week)

To review and finalize the *scheme structure of B.Tech. V Semester* under the flexible curriculum (Batch admitted in 2022-23).

Item ME8

S.No.	Automobile Engineering			Mechanical Engineering		
	Subject Code	Category	Subject Name & Title	Subject Code	Category	Subject Name & Title
1.	2190511	MC	Data Science	2120511	MC	Data Science
2.	2190512	DC	Advanced Manufacturing Technology (DC-9)	2120512	DC	Advanced Manufacturing Technology (DC-9)
3.	2190513	DC	Applied Thermodynamics (DC-10)	2120513	DC	Applied Thermodynamics (DC-10)
4.	2190514	DC	Heat and Mass Transfer (DC-11)	2120514	DC	Heat and Mass Transfer (DC-11)
5.	2190515	DC	Automotive Chassis (DC-12)	2120515	DC	Machine Design (DC-12)
6.	2190516	DLC	Minor Project-I	2120516	DLC	Minor Project-I**
7.	2190517	Seminar/ Self-Study	Self-learning/Presentation (SWAYAM/NPTEL/ MOOC)	2120517	Seminar/ Self-Study	Self-learning/Presentation (SWAYAM/NPTEL/ MOOC)*
8.	200xxx	CLC	Novel Engaging Course (Informal Learning)	200XXX	CLC	Novel Engaging Course (Informal Learning)
9.	2190518	DLC	Summer Internship Project-II (Evaluation)	2120518	DLC	Summer Internship Project-II (Evaluation)

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Item ME9	To review and finalize the syllabi for all <i>Departmental Core (DC) Courses</i> of B. Tech. <i>V Semester (for batch admitted in 2022-23)</i> 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	2190512	Advanced Manufacturing Technology	1	2120512	Advanced Manufacturing Technology
	2	2190513	Applied Thermodynamics	2	2120513	Applied Thermodynamics
	3	2190514	Heat and Mass Transfer	3	2120514	Heat and Mass Transfer
Item ME10	4	2190515	Automotive Chassis	4	2120515	Machine Design
	To review and recommend the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B. Tech. <i>V Semester (for batch admitted in 2022-23)</i> .					
	2190515: Automotive Chassis		2120515: Machine Design		2190514/2120514: Heat and Mass Transfer	
	1. Structural analysis of Chassis of a vehicle and its main components through Design tools. 2. Design, Calculation and simulation of Rack and Pinion mechanism to steer a vehicle using design tools. 3. Study and Structural analysis of Shock absorbers for two-wheeler and four-wheeler. 4. Assembly and dismantling of automotive engine and clutch.		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. Modeling 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.		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 by drop and film wise condensation method.	
Item ME11	To review and recommend the list of projects which can be assigned under the 'Skill based mini-project' category in various laboratory components based courses to be offered in B.Tech. <i>V Semester (for the batch admitted in 2022-23)</i> .					
	2190515: Automotive Chassis		2120515: Machine design		2190513/2120513: Heat and Mass Transfer	
	1. Study and Construction of physical model of Chassis layout and its main components. 2. Study and Construction of physical model of contactless braking system.		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		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 surfaces 5. Model showing the concept of radiation shields.	

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Item
ME12

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered (for batch admitted in 2022-23) 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	2120517/2190517(i)	4
2.	Principles of Vibration Control	2120517/2190517(ii)	4
3.	Design Thinking - A Primer	2120517/2190517(iii)	4

Item
ME13

To review and finalize the *scheme structure of B.Tech. III Semester* under the flexible curriculum (Batch admitted in 2023-24).

S.No.	Mechanical Engineering		
	Subject Code	Category	Subject Name
1.	3100025	BSC	Engineering Mathematics-II
2.	3120331	DC	Mechanics of Materials
3.	3120332	DC	Kinematics of Machines
4.	3120333	DC	Metal Cutting and Machine Tools
5.	3120334	DC	Fluid Mechanics and Hydraulic Machines
6.	3120335	DLC	Software lab
7.	3120336	DLC	Self-learning/Presentation (SWAYAM/NPTEL/MOOC)
8.	200XXX	CLC	Novel Engaging Course (Informal Learning)
9.	3120337	DLC	Skill Internship Project (Institute Level) (Evaluation)

Item
ME14

To review and finalize the syllabi for all Departmental Core (DC) Courses of *B. Tech. III Semester* (for batch admitted in 2023-24) under the flexible curriculum along with their COs.

Mechanical Engineering		
S.No.	Subject Code	Subject Name
1	3120331	Mechanics of Materials
2	3120332	Kinematics of Machines
3	3120333	Metal Cutting and Machine Tools
4	3120334	Fluid Mechanics and Hydraulic Machines

Item
ME15

To review and recommend the list of experiments and skill-based mini projects of *B.Tech. III semester* (for batch admitted in 2023-24).

List of Experiments	
3120332: Kinematics of Machines	3120334/3190334: FMHM
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.	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.

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	12. Determine the Coriolis'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	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 <table><tr><td>3120332: Kinematics of Machines</td><td>3120334/3190334: FMHM</td></tr><tr><td> 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. </td><td> 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. </td></tr></table>		3120332: Kinematics of Machines	3120334/3190334: FMHM	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.	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.																																								
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Item ME16	To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered in the <i>B.Tech .III Semester (for batches admitted in 2023-24)</i> in online mode under <i>Self-Learning/ Presentation</i>. <table><tr><td>S.No.</td><td>Name of Subject</td><td>Code</td><td>Week</td></tr><tr><td>1.</td><td>Manufacturing Processes - Casting And Joining</td><td>3120336(i)</td><td>4</td></tr><tr><td>2.</td><td>Understanding Design</td><td>3120336(ii)</td><td>4</td></tr><tr><td>3.</td><td>Product Design and development</td><td>3120336 (iii)</td><td>4</td></tr></table>		S.No.	Name of Subject	Code	Week	1.	Manufacturing Processes - Casting And Joining	3120336(i)	4	2.	Understanding Design	3120336(ii)	4	3.	Product Design and development	3120336 (iii)	4																												
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Item ME17	To review and recommend the <i>Scheme structure &Syllabi</i> of PG Programme (M.E./M.Tech./MCA/MBA) along with their Course Outcomes (COs) <table><tr><td>S.No.</td><td>Subject Code</td><td>Category</td><td>Subject Name</td></tr><tr><td>1.</td><td>560111</td><td>DC</td><td>Computational Techniques</td></tr><tr><td>2.</td><td>560112</td><td>DC</td><td>Production Engineering- I</td></tr><tr><td>3.</td><td>560118</td><td>DC</td><td>Maintenance Management</td></tr><tr><td>4.</td><td></td><td>DE</td><td>Elective-I</td></tr><tr><td>5.</td><td></td><td>SC</td><td>Specialization Course (SC-I)</td></tr><tr><td>6.</td><td>560120</td><td>DLC</td><td>Production Engineering Lab-I</td></tr><tr><td>7.</td><td>560121</td><td>DLC</td><td>5 Seminar / Presentation</td></tr><tr><td>8.</td><td>560122</td><td>NEC</td><td>Classified Novel Engaging Course (Activity Based Learning)</td></tr></table> <table><tr><td>Departmental Elective -I (DE-I)</td><td>Specialization Course (SC-I)</td></tr><tr><td>Flexible Manufacturing Systems</td><td>Computer Integrated Manufacturing</td></tr><tr><td>Ergonomics and Work Study</td><td></td></tr><tr><td>Total Quality Management</td><td></td></tr></table>		S.No.	Subject Code	Category	Subject Name	1.	560111	DC	Computational Techniques	2.	560112	DC	Production Engineering- I	3.	560118	DC	Maintenance Management	4.		DE	Elective-I	5.		SC	Specialization Course (SC-I)	6.	560120	DLC	Production Engineering Lab-I	7.	560121	DLC	5 Seminar / Presentation	8.	560122	NEC	Classified Novel Engaging Course (Activity Based Learning)	Departmental Elective -I (DE-I)	Specialization Course (SC-I)	Flexible Manufacturing Systems	Computer Integrated Manufacturing	Ergonomics and Work Study		Total Quality Management	
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Ergonomics and Work Study																																														
Total Quality Management																																														
Item ME18	To recommend the scheme structure and Syllabus of Ph.D. Course Work (specific to Doctoral Research Scholars, if any)																																													
Item ME19	To review the CO attainments, to identify gaps and to suggest corrective measures for the improvement in the CO attainment levels for all the courses taught during <i>July-Dec 2023 session</i>.																																													
Item ME20	To review the PO attainments levels and suggest the actions to be taken for improvement in PO attainment																																													

Dept. of Mechanical Engg.

BoS meeting Dated 30/05/2024

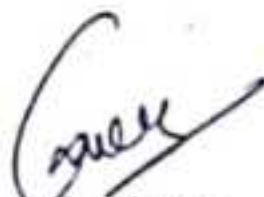
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Department of Mechanical Engineering

Item ME21	To review and finalize the CO-PO mapping matrix for all the courses to be taught in July-Dec 2024.
Item ME22	To review curricula feedback from various stakeholders, its analysis and impact
Item ME23	Any other matter

Following Suggestion given by expert

1. Subject entitled with "Advanced Production Technology" should be renamed as "Advanced Manufacturing Technology"
2. Subject entitled with "Theory of Machine" should be renamed as "Kinematics of Machines"
3. Instead of "powder Metallurgy" as a Departmental Elective for Automobile Engg. Some other more relevant subject may be introduced.


Dr. Gavendra Norkey
(BoS Member)


Dr. Nithin Upadhyay
(BoS Member)


Dr. Surendra Ku.
Chourasiya
(BoS Member)

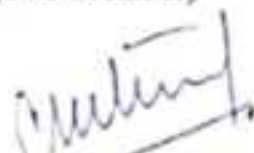

Mr. B. K. Pandey
(BoS Member)


Dr. Amit Ahirwar
(BoS Member)


Mr. V. Shivhare
(BoS Member)


Mr. Sharad Agrawal
(BoS Member)

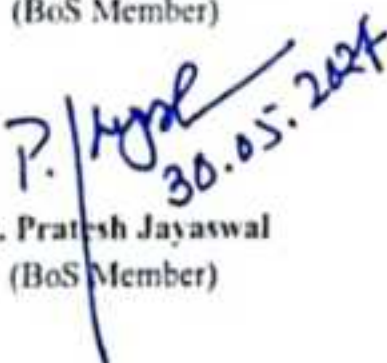

Dr. Jyoti Vimal
(BoS Member)


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
Er. Abhishek Khare
(Alumni)

online present
Dr. Mukul Shukla
(AC Nominee)

online present
Dr. Prashant Kumar Jain
(RGPV Nominee)


Dr. M. K. Gaur
(BoS Chairman)

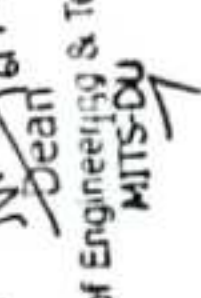

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Item ME2	To review and finalize the scheme structure of B.Tech. VII Semester with the provision of <i>Three (03) Departmental Electives (DEs) and Open Category (OC) Course. (Out of which One (01) Elective and 01 Open category course is to be offered in traditional mode and remaining Two (02) Departmental Electives are to be offered in online mode with credit transfer for the batch admitted in 2021-22.</i>
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IB.Tech (Mechanical Engineering) VII Semester																				
Maximum Marks Allotted																				
S. No.	Subject Code	Subject Name	Theory Slot				Practical Slot				MOOCs	Total Marks	Contact Hours per week			Mode of Teaching	Mode of Exam	Duration of Exam		
			End Term Evaluation		Continuous Evaluation		End Sem Exam	Continuous Evaluation		Lab Work & Sessional			Skill Based Mini Project	Assignment	Cum.					
			End Term Eval	Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment														
1	DE	Departmental Elective-2 (DE-2)	50	10	20	20	-	-	-	-	-	-	100	4	-	-	4	Blended	PP	2 hr
2	DE	Departmental Elective-3 (DE-3)	-	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 hr
3	DE	Departmental Elective-4 (DE-4)	-	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 hr
4	OC	Open Category-2 (OC-2)	50	10	20	20	-	-	-	-	-	-	100	2	1	-	3	Blended	PP	2 hr
5	DLC	Reliability and Vibration Lab (DLC-6)	-	-	-	-	-	-	-	60	20	20	100	-	-	2	1	Offline	SO	
6	DLC	Summer Internship Project-III (Institute Level) (Evaluation)	-	-	-	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO	
7	DLC	Creative Problem Solving (DLC-7)	-	-	-	-	-	-	-	25	25	-	50	-	-	2	1	Offline	SO	
Total			100	20	40	40	145	45	20	145	45	20	150	12	1	8	17			
8	MOOCs	Universal Human Values A Professional Ethics (UHV, PE)	50	10	20	20	-	-	-	-	-	-	100	2	-	-	-	Grade	MCQ	
Additional Courses for obtaining Honors/Minor Specialization by desirous students															Permitted to opt for maximum two additional courses for the award of Honours or Minor specialisation					
* 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																				
**PP: Pen Paper																				
**SO: Submission + Oral																				
* Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform with Credit Transfer																				

DE-2 (Through Traditional Mode)				DE-3*				DE-4*			
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name	S.No.	Subject Code	S.No.	Subject Code	Subject Name	Open Category (OC-2)
1	120732	Metrology, Measurement and Control	1	120761	Foundation of Computational Fluid Dynamics	1	120764	Fundamentals Of Additive Manufacturing Technologies			
2	120733	Total Quality Management	2	120762	Introduction to Composites	2	120765	Energy Conservation And Waste Heat Recovery			
3	120734	Turbo Machinery	3	120763	Advanced Machining Processes	3	120766	Work system Design			

Mode of Teaching										Mode of Examination			
Theory		Lab		SIP		Theory		Lab		SIP		Total Credits	
Offline	Online	Offline	Online	Offline	Online	PP	A+O	PP	A+O	PP	A+O		
0	6	3	3	0	0	43.3	8	43.3	8	50	50		
0	3.3	11.7	11.7	0	0	15.3	3	15.3	3	17	17		



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B.Tech. (Automobile Engineering) VII Semester

Sl. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted												Total Marks	Contact Hours per week			Mode of Teaching	Mode of Exam	Duration of Exam
				Theory Slot				Practical Slot				MOOCs										
				End Term Evaluation		Continuous Evaluation		End Sem Exam	Continuous Evaluation		Lab Work & Sessional	Skill Based Mini Project	Assignment	Exam								
				End Term Eval	Proficiency in subject /course	Mid Sem. Exams.	Quiz/ Assignment															
1.	DE	DE	Departmental Elective-2 (DE-2)	50	10	20	20	-	-	-	-	-	-	100	4	-	-	Bimodal	PP	2 hr		
2.	DE*	DE	Departmental Elective -3 (DE-3)	-	-	-	-	-	-	-	25	75	-	100	3	-	-	Online	MCQ	3 hr		
3.	DE*	DE	Departmental Elective -4 (DE-4)	-	-	-	-	-	-	-	25	75	-	100	3	-	-	Online	MCQ	3 hr		
4.	OC	OC	Open Category -2 (OC-2)	50	10	20	20	-	-	-	-	-	-	100	2	1	-	Bimodal	PP	2 hr		
5.	190715	DLC	Automotive Maintenance (DLC-6)	-	-	-	-	-	20	20	-	-	-	100	-	-	2	Offline	50			
6.	190716	DLC	Summer Internship Project-III (Institute Level) (Evaluation)	-	-	-	-	-	-	-	60	-	-	60	-	-	-	Offline	50			
7.	190717	DLC	Creative Problem Solving (DLC-7)	-	-	-	-	-	25	25	-	-	-	50	-	-	2	Offline	50			
8.	1000008	MAC	Universal Human Values & Professional Ethics (UHVE)	100	20	40	40	-	45	20	-	150	-	410	12	1	8	Offline	50			
Total				50	10	20	20	-	-	-	-	-	-	100	2	-	-	Online	MCQ			

Additional Courses for obtaining Honors/Minor Specialization by desirous students

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

*MCQ: Multiple Choice Questions

Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization

**Additional Courses for
obtaining Honors/Minor Specialization by desirous students**

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

• Course run through SWAYAM/NPTEL/MOOC Learning Based Platform with CLOs

DE-2 (Through Traditional Mode)			DE-3*			DE-4*			Open Category (OC-2)		
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	190731	Vehicle Dynamics	1	190761	Farm Machinery	1	190764	Sustainable Power Generation Systems	1	910208	Solar Energy
2	190732	Hybrid Electric Vehicles	2	190762	Mechanism and Robot Kinematics	2	190765	Aluminium based Alloys and Metal Matrix Composites	2	910209	Maintenance Engineering

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Item ME3	To propose the list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in online mode for Two (02) Departmental Electives (DE) Course, with credit transfer in the B.Tech. VII Semester under the flexible curriculum (Batch admitted in 2021-22).
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Departmental Elective (DE) category courses (DE-3 & DE-4)					
Mechanical Engineering			Automobile Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	120761	Foundation of Computational Fluid Dynamics	1	190761	Farm Machinery
2	120762	Introduction to Composites	2	190762	Mechanism and Robot Kinematics
3	120763	Advanced Machining Processes	3	190764	Sustainable Power Generation Systems
4	120764	Fundamentals of Additive Manufacturing Technologies	4	190765	Aluminium based Alloys and Metal Matrix Composites
5	120765	Energy Conservation And Waste Heat Recovery			
6	120766	Work system Design			

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120761: Foundation of Computational Fluid Dynamics

Category	Title	Code	Credit - 3			Theory Paper
Departmental Elective-DE 3	Foundation of Computational Fluid Dynamics	120761	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course:

https://onlinecourses.nptel.ac.in/noc24_me86/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22/07/2024	13 sep 2024	21 Sep 2024	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.

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120762: Introduction to Composites

Category	Title	Code	Credit - 3			Theory Paper
Departmental Elective-DE 3	Introduction to Composites	120762	L	T	P	As ^{per} SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course: -

https://onlinecourses.nptel.ac.in/noc24_me129/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 July 2024	11 Oct 2024	03 Nov 2024	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

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120763: Advanced Machining Processes

Category	Title	Code	Credit - 3			Theory Paper
Departmental Elective-DE3	Advanced Machining Processes	120763	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course:

https://onlinecourses.nptel.ac.in/noc23_me99/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
19 Aug 2024	11 Oct 2024	03 Nov 2024	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

120764: Fundamentals of Additive Manufacturing Technologies

Category	Title	Code	Credit - 3			Theory Paper
Departmental Elective-DE4	Fundamentals Of Additive Manufacturing Technologies	120764	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course :

https://onlinecourses.nptel.ac.in/noc24_me138/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jul 2024	11 Oct 2024	03 Nov 2024	12 Weeks

Course Layout

Week 1: Introduction to Additive Manufacturing

Week 2: Computer Aided Process Planning for Additive Manufacturing

Week 3: Computer Aided Process Planning for Additive Manufacturing

Week 4: Liquid Additive Manufacturing

Week 5: Liquid Additive Manufacturing

Week 6: Sheet Additive Manufacturing

Week 7: Wire Additive Manufacturing

Week 8: Wire Additive Manufacturing

Week 9: Wire Additive Manufacturing

Week 10: Powder Additive Manufacturing

Week 11: Powder Additive Manufacturing

Week 12: Powder Additive Manufacturing

Books and references

Venuvinod, Patri K., and Weiyin Ma. Rapid prototyping: laser-based and other technologies. Springer Science & Business Media, 2013.

Ian Gibson, David Rosen, and Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing. Springer, New York, NY, 2015.

Kumar, L. Jyothish, Pulak M. Pandey, and David Ian Wimpenny, eds. 3D printing and additive manufacturing technologies. Singapore: Springer, 2019.

Jacobs, Paul F. "Fundamentals of stereolithography." In 1992 International Solid Freeform Fabrication Symposium. 1992.

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120765: Energy Conservation and Waste Heat Recovery

Category	Title	Code	Credit - 3			Theory Paper
Departmental Elective-DE4	Energy Conservation And Waste Heat Recovery	120765	L	T	P	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course:

https://onlinecourses.nptel.ac.in/noc24_me142/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jul 2024	11 Oct 2024	03 Nov 2024	12 Weeks

Course layout

- Week 1** Introduction to Waste Heat, Importance of Waste Heat Recovery, Review of Thermodynamics - Introduction to First and Second Laws
- Week 2** Review of Thermodynamics - Entropy, Entropy Generation, First and Second Law efficiency
- Week 3** Power Plant Cycles - Energy Cascading, Rankine Cycle, modification of Rankine cycle, examples
- Week 4:** Gas Turbine Cycle, Combined Cycle, Combined Gas Turbine-Steam Turbine Power Plant, Heat Recovery Steam Generators
- Week 5:** Thermodynamic cycles for low temperature application, Cogenerations, Introduction to Heat Exchangers, Analysis - LMTD and ϵ -NTU method
- Week 6:** Analysis of Heat Exchanger - continued, Problem solving, Special Heat Exchangers for Waste Heat Recovery, Synthesis of Heat Exchanger Network
- Week 7:** Heat pipes & Vapor Chambers, Direct conversion technologies -Thermoelectric Generators
- Week 8:** Direct conversion technologies - Thermoelectric Generators (contd.), Thermionic conversion, Thermo-PV, MHD
- Week 9:** Heat Pump, Heat Recovery from Incinerators, Energy Storage - Introduction.
- Week 10:** Energy Storage Techniques - Pumped hydro, Compressed Air, Flywheel, Superconducting Magnetic storage
- Week 11:** Energy Storage Techniques - Thermal storage (Sensible & Latent), Battery, Chemical Energy Storage, Fuel cells.
- Week 12:** Energy Economics

Books and references

Nil

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120766: Work system Design

Category	Title	Code	Credit - 3			Theory Paper
Departmental Elective-DE4	Work system Design	120766	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course:

https://onlinecourses.nptel.ac.in/noc24_me125/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jul 2024	11 Oct 2024	03 Nov 2024	12 Weeks

Course layout

Week 1: Work System Design: Introduction, Introduction and Concept of Productivity, Measurement of Productivity, Productivity Measures, Productivity Measurement Models

Week 2: Factors Influencing Productivity, Causes of Low Productivity, Productivity Measurement Models, Productivity Improvement Techniques, Numerical Problems on productivity, Case study on productivity.

Week 3: Work Study: Basic Concept, Steps Involved in Work Study, Concept of Work Content, Techniques of Work Study, Human Aspects of Work Study

Week 4: Method Study: Basic Concept, Steps Involved in Method Study, Recording Techniques, Operation Process Charts, Operation Process Charts: Examples.

Week 5: Flow Process Charts, Flow Process Charts: Examples, Two-Handed-Process Charts, Multiple Activity Charts, Flow Diagrams.

Week 6: String Diagrams, Principles of Motion Economy, Micro-Motion Study, Therbligs, SIMO Charts

Week 7: Memo-Motion Study, Cycle graph and Chrono-Cycle Graph, Critical Examination Techniques, Development and Selection of New Method, Installation and Maintenance of Improved Methods.

Week 8: Work Measurement: Basic Concept, Techniques of Work Measurement, Steps Involved in Time Study, Steps and Equipment of Time Study, Performance Rating.

Week 9: Performance Rating: Examples, Allowances, Computation of Standard Time-I, Computation of Standard Time-II, Case Study

Week 10: Work Sampling: Basics, Procedure of Work Sampling Study, Numerical Problems on work sampling, Introduction to Synthetic Data and PMTS, Introduction to MTM and MOST

Week 11: Ergonomics: Basic Concept, Industrial Ergonomics, Ergonomics: Anthropometry, Man-Machine System-1, Man-Machine System-2

Week 12: Case Study: Office Chair, Case Study: Tower Crane Cabin, Case Study: Car Seat, Case Study: Computer System, Case Study: Assembly Line

Books and references

Introduction to Work Study: International Labor Office (ILO), Geneva. Motion and Time Study

Design and Measurement of Work: Ralph M. Barnes, Wiley, The University of California.

Industrial Engineering and Production Management: M. Telsang, S. Chand and Company Ltd.

190761: Farm Machinery

Category	Title	Code	Credit - 3			Theory Paper
Departmental Elective-DE3	Farm Machinery	190761	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course:

https://onlinecourses.nptel.ac.in/noc24_ag14/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
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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

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190762: Introduction to mechanical vibration

Category	Title	Code	Credit - 3			Theory Paper
Departmental Elective-DE3	Introduction to mechanical vibration	190762	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course:

https://onlinecourses.nptel.ac.in/noc24_me85/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jul 2024	13 Sep 2024	21 Sep 2024	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



190764: Sustainable Power Generation Systems

Category	Title	Code	Credit - 3			Theory Paper
Departmental Elective-DE4	Sustainable Power Generation Systems	190764	L 3	T -	P -	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course:

https://onlinecourses.nptel.ac.in/noc24_ge54/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jul 2024	11 Oct 2024	02 Nov 2024	12 Weeks

Course layout**Week 1: Module-1: Introduction to power generation**

Global and Indian scenario, an overview of current technologies available for power generation, Concept of the renewable energy- based power plant

Week 2: Module-2: Solar Thermal Power Generation

Fundamentals of Solar thermal energy conversion, solar thermal based power plant design and analysis (flat plate and concentrator), ORC, RC, and Stirling engine.

Week 3: Module-3: Solar Photovoltaic Power Generation

Fundamentals of Solar photovoltaic energy conversion, Solar PV power plant design, Performance analysis of standalone and grid connected PV systems.

Week 4: Module-4: Wind Power Generation

Introduction to wind turbine, classification and analysis of different components, Theory, design and analysis of wind turbines (horizontal axis and vertical axis) and wind farms.

Week 5: Module-5: Hydro Power Generation

Introduction to hydro power plant, overview of micro, mini and small hydro power plants, hydraulic turbines, Selection and design criteria of pumps and turbines, Brief theory, design and analysis of hydro power plants

Week 6: Module-6: Biomass Power Generation

Fundamentals of bioenergy production technologies through different routes, design and analysis of biochemical and thermochemical reactors for clean power generation and value- added products, IGCC.

Week 7: Module-7: Hydrogen energy and fuel cells

Importance, various routes of hydrogen generation, basic principle and design of different types of fuel cells and their applications, future prospects, IGFC

Week 8: Module-8: Geothermal Energy

Fundamentals, classification, theory, design and analysis of geothermal power plant

Week 9: Module-9: Ocean Thermal Energy

Fundamentals, classification, theory, design and analysis of ocean thermal power plant

Week 10: Module-10: Wave and Tidal Energy

Fundamentals, classification, theory, design, and analysis of wave and tidal power plant

Week 11: Module-11: Energy Storage

Different modes of energy storage; design and analysis of different technologies for thermal, mechanical, and electro-chemical energy storage systems

Week 12: Module-12: Energy Economics

Cost analysis, interest, Accounting rate of return, Payback, Discounted cash flow, Net present value, Internal rate of return, Inflation and life cycle analysis of energy systems.

Books and references

1. J. Twidell, T. Weir, Renewable Energy Resources, Taylor and Francis, 4th Edition, 2021.
2. G. Boyle (Editor), Renewable Energy: Power for a Sustainable Future, Oxford University press, 3rd Edition, 2012.
3. G. N. Tiwari, Solar Energy, Fundamentals, Design, Modeling and Applications, Narosa, 2002.
4. J. A. Duffie and W. A. Beckman, Solar Engineering of Thermal Processes, John Wiley, 4th Edition, 2013.
5. R. Gasch, J. Twele, Wind Power Plants: Fundamentals, Design, Construction and Operation, Springer, 2nd Edition, 2012.
6. P. Breeze, Hydropower, Elsevier, 1st Edition, 2018.
7. S. C. Bhattacharyya, Energy Economics Concepts, Issues, Markets and Governance, springer, 2nd Edition, 2019.
8. S.p Sukhatme and J.K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata Mc-Graw Hill Education Private Limited, 3rd Edition, 2010.

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190765: Aluminium based Alloys and Metal Matrix Composites

Category	Title	Code	Credit - 3			Theory Paper
Departmental Elective-DE 3	Aluminium based Alloys and Metal Matrix Composites	190765	L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_mm40/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jul 2024	11 Oct 2024	03 Nov 2024	12 Weeks

Week 1: Introduction, Pure Aluminium, Extraction of Aluminium, Removal of impurities, Alloy Designations, Cast Alloys, Al-Si alloys, Modification of Al-Si alloys

Week 2: Modifying Al-Si alloys, Alloy designations, Solid solution strengthening, Mechanisms of Solid solution strengthening. Buildup of solute atmosphere, Yield point phenomena, Strain aging, Cottrell-Bilby theory of strain aging.

Week 3: Portevin-Le Chatelier (PLC) effect, Dynamic Strain Aging (DSA), Penning theory of DSA, Precipitation hardening – Introduction.

Week 4: Precipitation hardening, T-T-T diagram of precipitation, Alloy tempers, GP zones, Natural Aging. Mechanisms of Precipitation hardening, Precipitation hardenable Alloys, Precipitation sequence.

Week 5: Properties of 7XXX series alloys; Precipitation sequence in 8XXX series alloys, Order strengthening in Al-Li alloys, Strain Hardening. Recovery & Recrystallization.

Week 6: Nucleation and Growth in Recrystallization, Dynamic Recrystallization, DDRX, CDRX, GDRX.

Week 7: Grain refinement strengthening, Grain refinement methods, Homogeneous and Heterogeneous Nucleation, Grain refinement by Melt inoculation.

Week 8: Mechanisms of grain refinement by melt inoculation, Fading & Poisoning, Grain refinement by melt vibration, Severe Plastic Deformation (SPD), Dynamic recrystallization in SPD.

Week 9: Metal Matrix Composites (MMC): Definition of composite, Processing of MMCs: Liquid state processing, Stir casting, Melt infiltration. Spray deposition, Solid state and Vapor state processing, Spray deposition, CVD and PVD. In situ Composites. Particle bonding and distribution in MMCs.

Week 10: Properties of Metal Matrix Composites, Rule of mixtures, Strengthening Mechanisms in MMCs.

Week 11: Fracture Behavior of composites, Ductile Fracture of Metals, Fracture Behavior of Discontinuously Reinforced Composites.

Week 12: Fatigue, Fatigue Behavior of MMCs

Books and references

1. Frank King, Aluminum and its Alloys, Ellis Horwood Publishers, 1987.
2. John E. Hatch, Aluminum – Properties and Physical Metallurgy, ASM, 3rd ed. (1988).
4. Subra Suresh, A. Mortensen, A Needleman, Fundamentals of Metal Matrix Composites, Butterworth-Heinemann, 1993.

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4. T. W. Clyne, P. J. Withers, An Introduction to Metal Matrix Composites, Cambridge University Press, 1993.

5. Ranjit Bauri, Devinder Yadav, Metal Matrix Composites by Friction stir processing, Butterworth-Heinemann, 2018.

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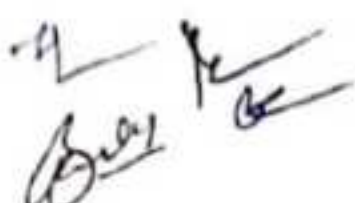
- Top row: Five distinct handwritten marks, including a large 'M' with a checkmark, a 'V' with a checkmark, a 'u' with a checkmark, a 'B' with a checkmark, and a signature 'R'.
- Bottom row: A large, stylized signature 'S'.

Item ME4	To prepare and finalize the syllabus of courses to be offered (<i>for batch admitted in 2021-22</i>) under <i>Departmental Elective (DE) Course</i> (in traditional mode) for B. Tech. <i>VII Semester</i> along with their COs
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Mechanical Engineering			Automobile Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	120732	Metrology, Measurement and Control	1	190731	Vehicle Dynamics
2	120733	Total Quality Management	2	190732	Hybrid Electric Vehicles
3	120734	Turbo Machinery			




**120732: Metrology, Measurement and Control**

Category	Title	Code	Credit-4			Theory Paper
Departmental Elective – DE2	Metrology, Measurement and Control	120732	L	T	P	Max. Marks-50 Duration-2 hrs.
			4	-	-	

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, IS1 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.

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Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	P5O1	P5O2
CO1	3	1	1	1	3	1	1	1	1	1	1	3	1	1
CO2	3	1	1	2	3	1	1	1	1	2	1	3	1	1
CO3	3	2	2	2	3	2	2	1	1	1	1	3	2	2
CO4	3	3	3	3	3	2	2	1	1	1	1	3	2	1
CO5	3	3	3	3	3	2	1	2	2	1	2	3	2	2
CO6	3	3	3	3	3	2	2	1	1	2	2	3	2	2

1 - Slightly; 2 - Moderately; 3 - Substantially

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.

**120733: Total Quality Management**

Category	Title	Code	Credit-4			Theory Paper
Departmental Elective - DE2	Total Quality Management	120733	1	1	P	Max Marks-50 Duration-2 hrs
			4	-	-	

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

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	P5O1	P5O2
CO1	3	1	1	1	3	1	1	1	1	1	1	3	1	1
CO2	3	1	1	2	3	1	1	1	1	2	2	3	1	1
CO3	3	1	2	2	3	2	2	1	1	1	2	3	2	1
CO4	3	2	3	3	3	2	2	1	2	1	3	3	1	1
CO5	3	2	3	3	3	2	1	2	2	2	3	3	1	1
CO6	3	2	3	2	3	2	2	1	2	2	3	3	1	1

1 - Slightly; 2 - Moderately; 3 - Substantially

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

By Mr. V. R. K. B. S. Q1



120734: Turbo Machinery

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	Max.Marks-50 Duration-2 hrs.
Departmental Electives-DE	Turbo Machinery	120734	4	-	-	

Course Objectives: To make the students to understand:

1. To enable the students know the operation of turbo-machines for compressible and incompressible fluids.
2. To provide students thorough understanding of velocity triangles, thermodynamic plots and losses in turbo-machinery.
3. To introduce students to fans, turbines, pumps etc.

Syllabus

UNIT-I INTRODUCTION:

Energy Transfer in Turbo Machines Application of first and second Laws thermodynamics to turbo machines. Moment of momentum equation and Euler turbine equation. Principles of Impulse and reaction machines, degree of reaction, energy equation for relative velocities, one dimensional analysis only.

UNIT-II STEAM TURBINE:

Impulse staging, velocity and pressure compounding utilization factor, analysis for optimum U.F. curtis stage, and Rateau stage, including qualitative analysis. Effect of blade and nozzle losses on Vane efficiency, Stage efficiency. Analysis for optimum efficiency vortex types of flow, flow with constant reaction. Governing and Performance characteristics of steam turbines.

UNIT-III WATER TURBINES:

Classification, pelton, Francis and Kaplan turbines, vector diagrams and work done Draft Tubes, governing or water turbines.

UNIT-IV CENTRIFUGAL PUMPS:

Classification, advantage over reciprocation type, definition of manometric head gross head, static head, vector diagram and work done. **Performance and Characteristics:** Application of dimensional analysis and similarity to water turbine and centrifugal pumps, unit and specific quantities, selection of machines, Hydraulic, volumetric mechanical and overall efficiencies, Main and operating characteristics of the machines cavitations.

UNIT-V ROTARY FANS, BLOWERS AND COMPRESSORS:

Classification based on pressure rise, Centrifugal and axial flow machines. **Centrifugal Blowers:** Vane shapes, Velocity triangle degree of reactions, slip coefficient speed of machine. Vane shape and stresses, efficiency characteristics. Fan laws and characteristics. **Centrifugal compressor :** Vector diagrams, work done, temp. and pressure ratio, slip factor, was input factor, pressure coefficient, Dimensions of inlet eye, impeller and diffuser. **Axial flow compressors:** Vector diagrams, work done factor, temp. and pressure ratio, degree reaction. Dimensional Analysis, Characteristics, surging, Polytropic and isentropic efficiencies.

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

1. Relate analytical problems in turbo-machines for both compressible and incompressible fluid flows.
2. Demonstrate the knowledge of working, stages, performance characteristics, governing and

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- selection of turbo-machinery
3. **Recognize** typical designs of turbo machines.
 4. **Determine** the velocity triangles in turbo machinery stages operating at design and off-design Conditions.
 5. **Explain** and understand how the flow varies downstream of a turbo machinery blade row
 6. **Analyze** the limitation and working of steam turbine and apply the principle moment of momentum equation.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	1	1	1	1	1	3	2	1
CO2	3	3	3	3	2	1	1	1	1	1	1	3	1	1
CO3	3	3	3	3	2	2	1	1	1	2	1	3	2	1
CO4	3	3	3	3	3	1	2	1	1	1	1	3	1	1
CO5	3	3	3	3	3	2	1	2	2	1	2	3	1	1
CO6	3	3	3	3	2	1	1	1	1	2	2	3	2	2

1 - Slightly; 2 - Moderately; 3 - Substantially

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190731: Vehicle Dynamics

Category	Title	Code	Credit-4			Theory Paper
Departmental Elective-DE2	Vehicle Dynamics	190731	L	T	P	Max.Marks-50 Duration-2hrs.
			4	-	-	

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.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	3	1	1	1	1	1	1	3	1	1
CO2	3	1	1	1	3	1	1	1	1	2	1	3	1	1
CO3	3	3	1	1	3	2	1	1	2	2	1	3	1	1
CO4	3	3	2	1	3	1	2	1	1	2	1	3	1	1
CO5	3	3	2	1	3	2	1	2	2	1	2	3	1	2
CO6	3	3	3	3	3	3	2	1	2	2	2	3	1	2

1 - Slightly; 2 - Moderately; 3 - Substantially

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.

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**190732- Hybrid Electric Vehicles**

Category	Title	Code	Credit-4			Theory Paper
Departmental Elective- DE2	Hybrid Electric Vehicles	190732	L	T	P	Max Marks-50 Duration-2hrs.
			4	-	-	

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 excited 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.



Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	3	1	1	1	1	1	1	3	1	1
CO2	3	1	1	1	3	1	1	2	1	2	1	3	1	1
CO3	3	2	2	2	3	2	1	2	2	2	1	3	1	1
CO4	3	3	2	1	3	1	2	2	1	2	1	3	1	1
CO5	3	3	2	1	3	2	1	2	2	1	2	3	1	2
CO6	3	3	3	3	3	3	2	2	2	2	2	3	1	2

1 - Slightly; 2 - Moderately; 3 - Substantially

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. Mehrdad Ehsani, "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. Lino Guzzella, "Vehicle Propulsion System" Springer Publications, 2005.

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Item ME5	To prepare and finalize the syllabus of courses to be offered (for batch admitted in 2021-22) 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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Open Category (OC-2)		
S.No.	Subject Code	Subject Name
1	910208	Solar Energy
2	910209	Maintenance Engineering

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**910208: SOLAR ENERGY**

Category	Title	Code	Credit-3			Theory Paper
Open Course-OC2	Solar Energy	910208	L	T	P	Max. Marks - 50 Duration - 2 hrs
			2	1	-	

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.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	3	1	1	1	1	1	1	3	1	1
CO2	3	1	1	1	3	1	1	1	1	1	1	3	2	2
CO3	3	3	3	3	3	2	1	1	1	2	1	3	2	2
CO4	3	3	3	3	3	1	2	1	1	1	1	3	2	2
CO5	3	3	3	3	3	2	1	2	2	1	2	3	2	2

1 - Slightly; 2 - Moderately; 3 - Substantially



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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910209: Maintenance Engineering

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	Max.Marks-50 Duration-2 hrs.
Open Course-OC2	Maintenance Engineering	910209	2	1	-	

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.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	3	1	1	1	1	1	1	3	1	1
CO2	3	2	2	1	3	1	1	1	1	1	1	3	1	1
CO3	3	3	3	3	3	2	1	1	1	1	1	3	2	1
CO4	3	3	3	3	3	1	1	1	1	1	1	3	2	1
CO5	3	3	3	3	3	1	1	1	1	1	1	3	2	1

1 - Slightly; 2 - Moderately; 3 - Substantially

Text & Reference books:

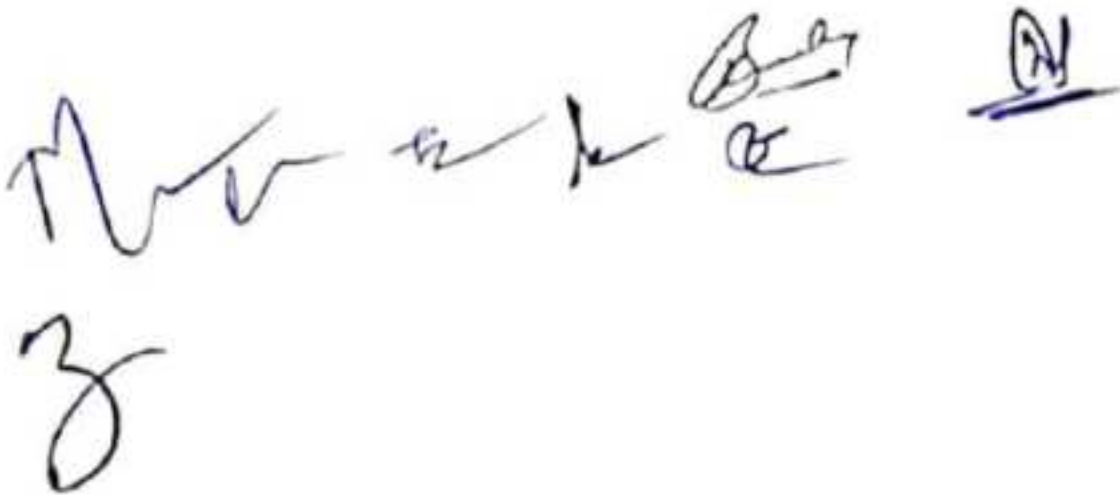
- A. R. Mohanty, Machinery Condition Monitoring: Principles and Practices, CRC Press, 2014
- Bikash Bhadury, "Total Productive Maintenance". Allied Publisher Ltd. New Delhi.
- BC langlay, "Plant Maintenance". Prentice-Hall International. New Jersey.
- P Gopalakrishnan and AK Banerji, "Maintenance and 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.

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MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Deemed to be University)
Department of Mechanical Engineering

Item ME6	To review and finalize the Experiment list/ Lab manual for Departmental Laboratory Course (DLC) to be offered in B. Tech. VII semester <i>(for batches admitted in 2021-22).</i>
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S.No.	Subject Code	Subject Name
1	120715	Reliability and Vibration Lab
2	190715	Automotive Maintenance



MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Deemed to be University)
Department of Mechanical Engineering

120715- (DLC-): Reliability and Vibration Lab

Category	Title	Code	Credit - I			Practical Paper
Departmental Lab Core- DLC	Reliability and Vibration Lab	120715	L	T	P	Max.Marks-60
			-	-	2	Min.Marks-19

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.



190715: Automotive maintenance lab

Category	Title	Code	Credit-I			Lab End term
Departmental Laboratory Course - DLC	Automotive maintenance lab	190715	L	T	P	Max. Marks: 60
			-	-	2	Min Marks: 19

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) <i>Honours (for students of the host department)</i> (ii) <i>Minor Specialization (for students of other departments)</i> <i>These will be offered through SWAYAM/NPTEL/MOOC based Platforms for the B.Tech. VII semester students (for the batch admitted in 2021-22) and for B.Tech. V semester (for the batch admitted in 2022-23)</i>
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M. K. Singh
8

Honors list (For Mechanical/Automobile Engg. V & VII Sem Students.)

Sr No	Design Track		Thermal Track		Production Track	
	Honors (Jan.-June)	Honors (July-Dec.)	Honors (Jan.-June)	Honors (July-Dec.)	Honors (Jan.-June)	Honors (July-Dec.)
1	Design, Technology and Innovation(8 week)	Advanced Materials and Processes (12 week)	Computational Fluid Dynamics for Incompressible Flows(12 Weeks)	Power Plant Engineering (8week)	Introduction To Mechanical Micro Machining(8 weeks)	Fundamentals of manufacturing processes (12 week)
2	Experimental Stress Analysis(12 weeks)	Engineering Fracture Mechanics (12 week)	Turbulent Combustion: Theory And Modeling (12 weeks)	Advanced Thermodynamics and Combustion (12 week)	Product Design and Manufacturing(12 weeks)	Rapid Manufacturing (12 week)
3	Robotics: Basics and Selected Advanced Concepts(8 weeks)	Introduction To Composites (12 week)	Experimental Methods in Fluid Mechanics(12 Weeks)	Applied Computational Fluid Dynamics (12 week)	Mechanics of Fiber Reinforced Polymer Composite Structures(12 weeks)	Fundamentals of Additive Manufacturing Technologies (12 week)
4	Modeling and Simulation of Dynamic Systems(8 Weeks)	Solid Mechanics (12 week)	Heat Transfer and Combustion in Multiphase Systems(8 Weeks)	Fundamentals of Convective Heat Transfer (12 week)	Fundamentals Of Electronic Materials And Devices (8 weeks)	Automation in Manufacturing (12 week)

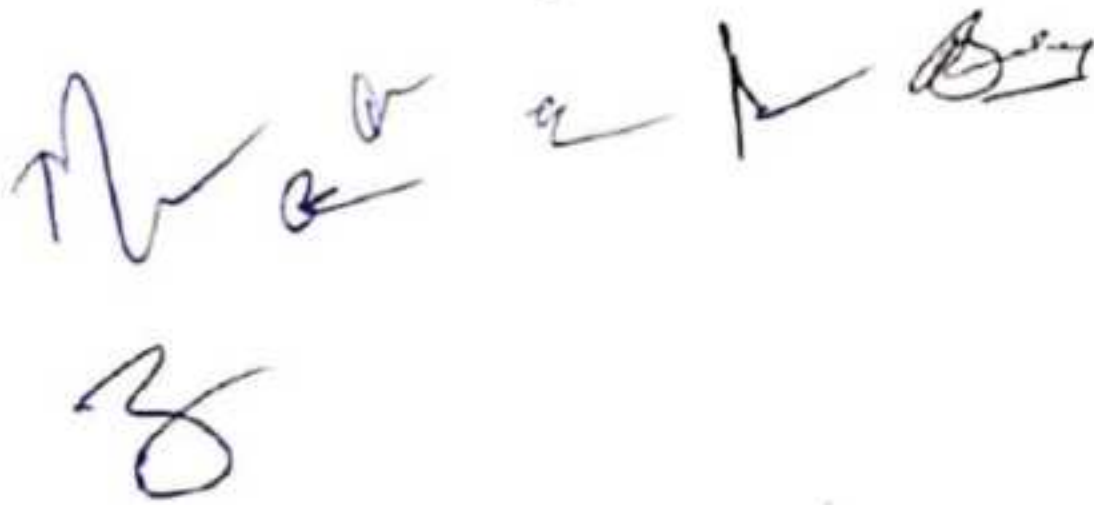
Advances in welding and joining technologies
Metallurgical and electronic waste recycling.

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

Sem	V (for the batch admitted in 2022-23)	VI (for the batch admitted in 2021-22)	VII (for the batch Admitted in 2021-22)
Course Name	1. Materials Processing (Casting, Forming and Welding) (12 Weeks) 2. Fluid Mechanics (12 Weeks)	1. Fundamental of Combustion (12weeks) 2. Introduction to Mechanical Micro Machining (12 weeks)	1. Engineering Metrology (12 Weeks) 2. Applied Thermodynamics for Engineers (12 Weeks)

M P V F Q J Q L

Item MES	To review and finalize the <i>scheme structure of B.Tech. V Semester under the flexible curriculum (Batch admitted in 2022-23).</i>
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B.Tech. V Semester (Mechanical Engineering)

Maximum Marks Allotted

S. No.	Code	Code	Maximum Marks Allotted	Theory Slot										Practical Slot			Total Marks	Contact Hours per week			Mode of Teaching	Mode of Exam.	Duration of Exam
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Lab work & Sessional	Skill Based Mini Project	L	T	P								
				End Sem. Exam.	Proficiency in subject/course	Mid Sem. Exam.	Quiz/Assignment																
1	2120511	MC	Data Science	50	10	20	20	60	20	20	3	-	2	4	Blended	MCQ	1.5 hr						
2	2120512	DC	Advanced Manufacturing Technology (DC-9)	50	10	20	20	-	-	-	3	-	-	3	Blended	PP	2 hr						
3	2120513	DC	Applied Thermodynamics (DC-10)	50	10	20	20	-	-	-	2	1	-	3	Blended	PP	2 hr						
4	2120514	DC	Heat and Mass Transfer (DC-11)	50	10	20	20	60	20	20	2	1	2	4	Blended	PP	2 hr						
5	2120515	DC	Machine Design (DC-12)	50	10	20	20	60	20	20	2	1	2	4	Blended	AO	2 hr						
6	2120516	DLC	Minor Project-I**	-	-	-	-	60	40	-	-	-	4	2	Offline	SO	-						
7	2120517	Seminar/Self-Study	Self-learning/Presentation (SWAYAM/NPTEL/ MOOC)*	-	-	-	-	-	40	-	-	-	2	1	Offline	SO	-						
8	200XXN	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	-	-	2	1	Offline	SO	-						
9	2120518	DLC	Summer Internship Project-II (Evaluation)	-	-	-	-	60	-	-	-	-	4	2	Offline	SO	-						
Total				250	50	100	100	350	140	60	12	3	18	25	Blended	-	-						
10.	1000006	MAC	Disaster Management	50	10	20	20	-	-	-	2	-	-	Grade	Online	MCQ	1.5 hr						
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/ experience attained etc.				Proficiency in course/subject-includes the weightage towards ability/skill/competence/knowledge/level/ experience attained etc.																			

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
PP: Pen Paper
AO: Assignment + Oral
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

Mode of Teaching					Mode of Examination				Total Credits
Theory			Lab		Theory		Lab		
Offline	Online	Blended	Offline	Online	PP	A+O	MCQ	SO	
0	0	18	-	5	7	7	4	5	23
0	0	75	-	20.8	29.16	29.16	18.88	20.8	108

Signature of Dean

Faculty of Engineering & Technology
MITS-DU50



B.Tech. V Semester (Automobile Engineering)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted													Total Marks	Contact Hours per week			Mode of Teaching	Mode of Exam.	Duration of Exam
				Theory Slot					Practical Slot														
				End Term Evaluation		Continuous Evaluation			End Sem. Exam.	Lab work & Sessional	Continuous Evaluation		Skill Based Mini Project										
				End Sem. Exam.	Proficiency in subject/course	Mid Sem. Exam.	Quiz/ Assignment	Lab work & Sessional			Skill Based Mini Project												
1.	2190511	MC	Data Science	50	10	20	20	20	60	20	20	20	200	3	-	2	4	Blended	MCQ	1.5 hr			
2.	2190512	DC	Advanced Manufacturing Technology (DC-9)	50	10	20	20	20	-	-	-	-	100	2	-	-	2	Blended	PP	2 hr			
3.	2190513	DC	Applied Thermodynamics (DC-10)	50	10	20	20	20	-	-	-	-	100	2	1	-	4	Blended	PP	2 hr			
4.	2190514	DC	Heat and Mass Transfer (DC-11)	50	10	20	20	20	60	20	20	20	200	2	1	2	4	Blended	PP	2 hr			
5.	2190515	DC	Automotive Chassis (DC-12)	50	10	20	20	20	60	20	20	20	200	2	1	2	3	Blended	PP	2 hr			
6.	2190516	DLC	Minor Project-I	-	-	-	-	-	60	40	-	-	100	-	-	4	2	Offline	SO	2 hr			
7.	2190517	Seminar/ Self-Study	Self-learning Presentation (SWAYAM/NPTEL/ MOOC) *	-	-	-	-	-	-	40	-	-	40	-	-	2	1	Offline	SO	-			
8.	200xxx	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	-	50	-	-	-	50	-	-	2	1	Offline	SO	-			
9.	2190518	DLC	Summer Internship Project-1 (Evaluation)	-	-	-	-	-	60	-	-	-	60	-	-	4	2	Offline	SO	-			
Total				250	50	100	100	100	350	140	60	60	1050	15	3	18	25	2	MCQ	1.5 hr			
10.	1000006	MAC	Disaster Management	50	10	20	20	20	-	-	-	-	100	2	-	-	-	Grade	MCQ	1.5 hr			
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.				15																			
MCO: Multiple Choice Questions				15																			

Additional Course for 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

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

Mode of Teaching									Mode of Examination				Total Credits
Offline		Theory		Lab		NEC		Theory		Lab			
	Online	Offline	Blended			Offline	Interactive	PP	A+O	MCQ	SO		
0	0	18	-			5	1	7	7	4	5	50	
0	0	25	-			29.8	4.1	29.16	29.16	16.66	10.8	1	
												23	
												100	

Signature of Dean

Dean
Faculty of Engineering & Technology
MITS-DU

Item ME9	To prepare and recommend the syllabi for all <i>Departmental Core (DC) Courses</i> of B. Tech. <i>V Semester (for batch admitted in 2022-23)</i> under the flexible curriculum along with their COs.
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Approved by
AB



Automobile Engineering			Mechanical Engineering		
S.No.	Subject Code	Subject Name	S.No.	Subject Code	Subject Name
1	2190512	Advanced Manufacturing Technology	1	2120512	Advanced Manufacturing Technology
2	2190513	Applied Thermodynamics	2	2120513	Applied Thermodynamics
3	2190514	Heat and Mass Transfer	3	2120514	Heat and Mass Transfer
4	2190515	Automotive Chassis	4	2120515	Machine Design

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**2190512/2120512: Advanced Manufacturing Technology**

Category	Title	Code	Credit-2			Theory Paper
Department Core -DC	Advanced Manufacturing Technology	2190512/2120512	L	T	P	Max.Marks-50
			2	-	-	Duration-2 hrs.

Course Objectives: To make the student understand:

1. the application of computers in various aspects manufacturing to reduce manual processing and linking computers to all the manufacturing machines and increase the productivity and reduces the unnecessary costs.
2. the fundamental of automation and brief history of robot configurations, sensors, end effectors, vision systems and to impart knowledge of various additive manufacturing Technologies for application to various industrial needs.

Pre-requisite: Manufacturing Processes, Metal cutting

Syllabus

UNIT-I FUNDAMENTALS OF NC, CNC & DNC MACHINES: Principles of numerical control, types of CNC machines, features of CNC systems, integration of CNC machines in CIM environment, Direct numerical control (DNC), Open loop system, Closed loop system.

UNIT-II CONSTRUCTIONAL FEATURES OF CNC MACHINES and PART PROGRAMMING: Features of CNC Machines such as Structure, Drive Mechanism, Main drive, feed drive, Spindle Motors, Axes motors, Tool magazines, ATC, Control systems, Feedback devices, Input media and coding formats. Manual part programming for Lathe, Drilling and Milling machines, Cutter diameters and Length compensation. Computer assisted part programming Languages APT, EXPAT, ADAPT, COMPACT. Computer numerical control, direct and distributed numerical control, adaptive control.

UNIT-III GROUP TECHNOLOGY & FLEXIBLE MANUFACTURING SYSTEMS: - GT Part Families, Classification & coding, M/C Cell Design, Benefits of GT, FMS Workstations, Material Handling & Storage Systems, Computer Control System, Planning of FMS Analysis Methods. Basic Elements of an Automated system, Levels of Automation.

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, selecting assembly machines Feeding and transfer of arts, applications of robots in manufacture and assembly.

UNIT-V ADDITIVE MANUFACTURING: Introduction and Basic Principles of Additive Manufacturing, Development of Additive Manufacturing Technology, Generalized Additive Manufacturing Processes, Photopolymerization Processes / Powder based system Processes / Extrusion-Based Systems, Material Jetting / Binder Jetting / Sheet Lamination/sintering Processes, Prototyping, Rapid Tooling, Applications of Additive Manufacturing, Comparison of Additive Manufacturing Methods.

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

- CO1** Illustrate the concepts/components of computer integrated manufacturing and integrate them in a coordinated fashion.
- CO2** Demonstrate the machining operations, programming languages and its control system used for solving practical problems of automation based.
- CO3** Compare the components of computer integrated manufacturing and integrate them in a coordinated manner.



CO4 Decide between the various trade-offs when selecting AM processes, devices and materials to suit particular engineering requirements.

CO5 Designing Flexible manufacturing cell after carrying out Group technology study, Automated Material Handling Systems, Automated Inspection Systems and finally creating FMS.

CO6 Knowledge in the broad spectrum of Production Engineering.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	-	3	1	1	1	2	1	1	3	1	1
CO2	3	3	1	-	3	1	1	1	1	1	1	3	1	1
CO3	3	3	2	1	3	2	1	1	1	1	1	3	1	2
CO4	3	3	3	2	3	1	2	1	1	1	1	3	1	1
CO5	3	3	3	3	3	2	1	1	1	1	1	3	2	1
CO6	3	3	3	3	3	3	2	3	1	1	1	3	2	2

1 - Slightly; 2 - Moderately; 3 - Substantially

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. Computer control of machine tools by Koren Yoram, Tata McGraw Hill publication
4. Manufacturing Engineering And Technology by Serope Kalpakjian, PHI publication.
5. CAD/CAM/CIM by Bhupendra Gupta, Dhanpat Rai publication
6. Gibson, Rosen, Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing. Springer, 2009.
7. Hopkinson, Hague, Dickens, Rapid Manufacturing: An Industrial Revolution for the Digital Age. Wiley, 2005.

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2190513/2120513: Applied Thermodynamics

Category	Title	Code	Credits -3			Theory Paper
Departmental Core-DC	Applied Thermodynamics	2190513/ 2120513	L	T	P	Max.Marks-50 Duration-2 hrs.
			2	1	-	

Course Objectives: To make the students understand:

1. the fundamental principles of Fuels 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

UNIT II – Fuels and combustion

Introduction, Classification of fuels, Basic chemistry, Combustion equations, Theoretical air and excess air, Stoichiometric air fuel (A/F) ratio, Air-fuel ratio from analysis of products, conversion of volumetric analysis to weight analysis, Conversion of weight analysis to volumetric analysis, Weight of carbon in flue gases, Weight of flue gases per kg of fuel burnt.

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,

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 Steam Nozzles

Introduction, Types of Steam Nozzles, Flow of Steam through Convergent-divergent Nozzle Friction in a Nozzle or Nozzle Efficiency, Velocity of Steam Flowing through a Nozzle, Mass of Steam Discharged through a Nozzle, Condition for Maximum Discharge through a Nozzle (Critical Pressure Ratio), Values for Maximum Discharge through a Nozzle, Values for Critical Pressure Ratio, Physical Significance of Critical Pressure Ratio, Diameters of Throat and Exit for Maximum Discharge. Supersaturated Flow or Metastable Flow through Nozzles, Effect of Supersaturation.

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

- O1: analyze the performance of steam power plant
- O2: describe and analysis of Fuels and combustion
- O3: analyze the performance of gas turbine power plant
- O4: describe the working of various types of steam turbine
- O5: solve analytical problems of Steamnozzles



Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	1	1	1	1	1	3	1	1
CO2	3	3	3	3	2	1	1	1	1	1	1	3	1	-
CO3	3	3	3	3	2	2	1	1	1	1	1	3	1	1
CO4	3	3	3	3	3	1	2	1	1	1	1	3	1	1
CO5	3	3	3	3	3	2	1	2	2	1	2	3	1	1

1 - Slightly; 2 - Moderately; 3 - Substantially

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

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**2190514/2120514: Heat and Mass Transfer**

Category	Title	Code	Credits -4			Theory Paper
Departmental Core-DC	Heat and Mass Transfer	2190514/ 2120514	L	T	P	Max.Marks-50 Duration-2 hrs.
			2	1	2	

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

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	P5O1	P5O2
CO1	3	3	3	3	2	1	1	1	1	1	1	3	2	1
CO2	3	3	3	3	2	1	1	1	1	1	1	3	1	1
CO3	3	3	3	3	2	2	1	1	1	2	1	3	2	1
CO4	3	3	3	3	3	1	2	1	1	1	1	3	1	1
CO5	3	3	3	3	3	2	1	2	2	1	2	3	1	1
CO6	3	3	3	3	2	1	1	1	1	2	2	3	2	2

1 - Slightly; 2 - Moderately; 3 - Substantially

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.

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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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**2190515: Automotive chassis**

Category	Title	Code	Credit-4			Theory Paper Max.Marks-50 Duration-2hrs.
			L	T	P	
Departmental Core- DC	Automotive chassis	2190515	2	1	2	

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.

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**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.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	3	1	1	1	1	1	1	3	1	1
CO2	3	1	1	1	3	1	1	1	1	2	1	3	1	1
CO3	3	3	1	1	3	2	1	1	2	2	1	3	1	1
CO4	3	3	2	1	3	1	2	1	1	2	1	3	1	1
CO5	3	3	2	1	3	2	1	2	2	1	2	3	1	2
CO6	3	3	3	3	3	3	2	1	2	2	2	3	1	2

1 - Slightly; 2 - Moderately; 3 - Substantially

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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2120515: Machine Design

Category		Title	Code	Credit -4			Theory Paper
Departmental DC	Core-	Machine Design	2120515	L	T	P	Max.Marks-50 Duration-2hrs.
				2	1	2	

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

Course Pre-Requisites:

1. Mechanics of Materials

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.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	3	1	1	1	1	1	1	3	1	1
CO2	3	1	1	2	3	1	1	1	1	1	1	3	1	1
CO3	3	2	1	2	3	2	2	1	1	1	1	3	1	2
CO4	3	3	3	3	3	2	2	1	1	1	1	3	1	1
CO5	3	3	3	3	3	2	1	2	2	1	2	3	1	1
CO6	3	3	3	3	3	2	2	1	1	1	1	3	1	2

1 - Slightly; 2 - Moderately; 3 - Substantially

Text Books

1. Shigley, J.E., and Charles Mechanical 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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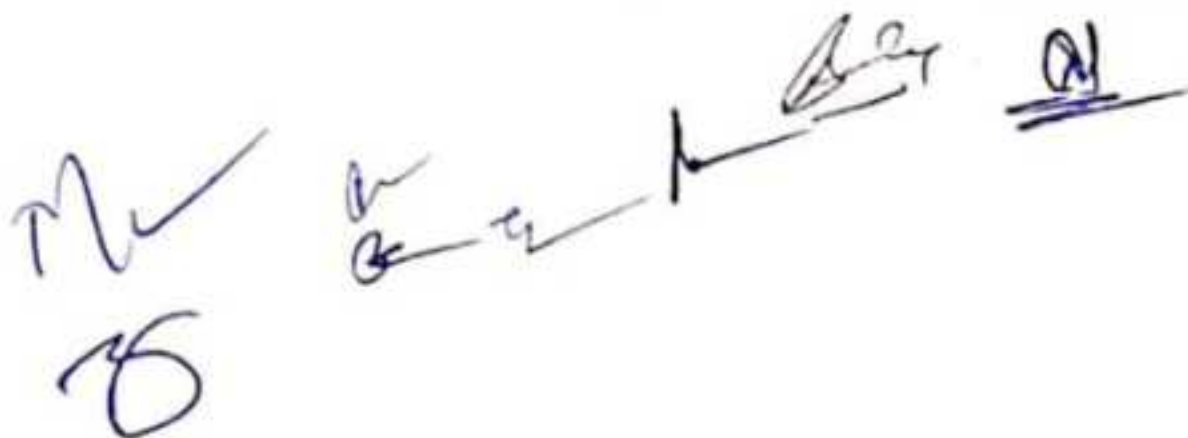
Item ME12	To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered (for batch admitted in 2022-23) in online mode under <i>Self-Learning/ Presentation</i> , in the B.Tech. V Semester.
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Self-study courses-V Sem (July-Dec 2024)

S.No.	Name of Subject	Code	Week
1.	Foundations of Cognitive Robotics	2120517/2190517(i)	4
2.	Principles Of Vibration Control	2120517/2190517(ii)	4
3.	Design thinking-A Primer	2120517/2190517(iii)	4

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Foundations of Cognitive Robotics

Category	Title	Code	Credit - I			Internal Evaluation
Self-study courses (i)	Foundations of Cognitive Robotics	2120517/	L	T	P	PPT Presentation Report Writing
		2190517	-	-	2	

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_me82/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22/07/2024	16 Aug 2024	22 Sep 2024	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.

Principles of Vibration Control

Category	Title	Code	Credit - I			Internal Evaluation
Self-study courses (ii)	Principles of Vibration Control	2120517/ 2190517	L	T	P	PPT Presentation /Report Writing
			-	-	2	

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_mc83/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22/07/2024	16 Aug 2024	22 Sep 2024	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

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

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Design thinking-A Primer

Category	Title	Code	Credit - I			Internal Evaluation
Self-study courses (iii)	Design thinking-A Primer	2120517/2190517	L	T	P	PPT Presentation Report Writing
			-	-	2	

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_mg72/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22-07-2024	16-Aug-2024	22-Sep-2024	4 Weeks

Course layout

Week 1 : Introduction to Design Thinking

Week 2 : Empathize Phase: Customer Journey Mapping

Week 3 : Analyze Phase: 5-Whys and How might we...

Week 4 : Solve Phase: Ideation: Free Brainstorming & Make/Test Phase: Prototype

Books and references

Prescribed Textbook for the course:

Karmic Design Thinking by Prof. Bala Ramadurai, available at [Amazon](#) (paperback), [Amazon](#) (e-book), [Flipkart](#), [Poohi](#), [bookspace.in](#)

References:

1. Design: Creation of Artifacts in Society by Prof. Karl Ulrich, U. Penn
2. Change by Design by Tim Brown.

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Item ME13	To review and finalize the <i>scheme structure of B.Tech. III Semester under the flexible curriculum (Batch admitted in 2023-24).</i>
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(Deemed to be University)

NAAC Accredited with A++ Grade

Department of Mechanical Engineering

For batch admitted in Academic Session 2023-24

Scheme of Evaluation



B. Tech III Semester (Mechanical Engineering) 7

B. Tech III Semester (Mechanical Engineering) 7																					
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.	Duration of Exam.
				Theory Slot					Practical Slot												
				End Term Evaluation			Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Continuous Evaluation									
				End Sem. Exam	Proficiency in subject/course	Mid Sem. Exam.	Quiz/ Assignment	Lab Work & Seasonal		Skill Based Mini Project											
1.	3100025	BSC	Engineering Mathematics-II	50	10	20	20	-	-	-	-	100	2	1	-	3	Blended	PP	2 hr		
2.	3120331	DC	Mechanics of Materials	50	10	20	20	40	30	30	30	200	2	1	2	4	Blended	TP	2 hr		
3.	3120332	DC	Kinematics of Machines	50	10	20	20	40	30	30	30	200	2	1	2	4	Blended	A/O	2 hr		
4.	3120333	DC	Metal Casting and Machine Tools	50	10	20	20	-	-	-	-	100	3	-	-	3	Blended	TP	2 hr		
5.	3120334	DC	Fluid Mechanics and Hydraulic Machines	50	10	20	20	40	30	30	30	200	2	1	2	4	Blended	TP	2 hr		
6.	3120335	DLC	Software lab	-	-	-	-	40	30	30	30	100	-	-	2	1	Online	SO	-		
7.	3120336	DLC	Self-learning Presentation (SWAYAM NPTEL MOOC)	-	-	-	-	-	40	-	-	40	-	-	2	1	Online	SO	-		
8.	200NXX	CLC	Novel Learning Course (Informal Learning)	-	-	-	-	50	-	-	-	50	-	-	2	1	Online	SO	-		
9.	3120337	DLC	Skill Internship Project (Institute Level) (Practical)	-	-	-	-	60	-	-	-	60	-	-	4	2	Online	SO	-		
Total				250	50	100	100	270	160	120	120	1050	11	4	16	23	-	-	-		
10.	3000001	Natural Sciences & Maths	Engineering Physics	50	10	20	20	30	10	10	10	150	1	-	2	Grade	Blended	MCQ	1.5 hr		
11.	1000005	MAC	Project Management & Finance	50	10	20	20	-	-	-	-	100	2	-	-	Grade	Online	MCQ	1.5 hr		

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

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

Mode of Teaching				Mode of Examination					Total Credits	
Theory		Lab		Theory		Lab		SIP/SLP/NEC		Total Credits
Offline	Online	Blended	Blended	Offline	Interactive	PP	A+O	MCQ	SO	
0	0	18	0	4	1	15	3	0	1	23
0	0	78.26	0	17.39	4.3	65.21	13	0	4.3	160

Signature of Dean

Dean
Faculty of Engineering & Technology
MITS-DU

4

Item ME14	To review and finalize the syllabi for all Departmental Core (DC) Courses of <i>B. Tech. III Semester</i> (for batch admitted in 2023-24) under the flexible curriculum along with their COs.
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Mechanical Engineering		
S.No.	Subject Code	Subject Name
1	3120331	Mechanics of Materials
2	3120332	Kinematics of Machines
3	3120333	Metal Cutting and Machine Tools
4	3120334	Fluid Mechanics and Hydraulic Machines

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**3120331: Mechanics of Materials**

Category	Title	Code	Credit-4			Theory Paper
Departmental Core-DC	Mechanics of Materials	3120331	L	T	P	Max.Marks-50
			2	1	2	Duration-2 hrs.

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 Simple Stress and strain: Introduction, Types of stresses, Elongation of a bar, Principal of superposition of forces, Stress-strain relationship and elastic constants, Poisson's ratio; Thermal stresses.

Strain Energy: Strain energy due to direct stress, simple shear, torsion and bending in beams.

Unit-II Compound stress-strain: Estimation of stresses on an inclined plane by analytical and graphical method (Mohr's circle method) for plane stress and plane strain, Principal stresses, Maximum shear stress calculations

Unit-III Stresses in beams: Shear Force & Bending Moment diagram, theory of simple bending, Section Modulus, bending Stresses.

Slope and deflection: Equation of Elastic Curve, Macaulay's Method, Area Moment Method, Strain Energy Methods etc.

Unit- IV Shear stress distribution: Variation of shear stress, Shear stress distribution in rectangular, circular, triangular and I-sections

Shafts: Torsion of circular shaft, stress concentration in shafts; series and parallel combination.

Unit -V 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.

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.



Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	3	1	1	1	2	1	1	3	1	-
CO2	3	3	2	-	3	1	1	1	1	1	-	3	1	-
CO3	3	3	2	3	2	2	1	1	1	1	1	3	1	2
CO4	3	3	3	3	3	1	2	1	1	1	1	3	1	1
CO5	3	3	3	3	3	2	1	1	1	1	1	3	2	-
CO6	3	3	3	3	3	3	2	3	1	1	1	3	2	2

1 - Slightly; 2 - Moderately; 3 - Substantially

Text & Reference Books

1. Strength of Materials (MoM) by R S Lehi and A S Lehi; 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 Nostrand Company.
5. Mechanics of Solids by Mubeen; Pearson Education Pub
6. Strength of Materials by S Ramamrutham, R Narayan; Dhanpat Rai sons Pub.

NPTEL Link for Mechanics of Material

https://onlinecourses.nptel.ac.in/noc18_cc04/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.

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3120332: Kinematics of Machines

Category	Title	Code	Credit-4			Theory Paper
Departmental Core-DC	Kinematics of Machines	3120332	L	T	P	Max.Marks-50 Duration-2 hrs.
			2	1	2	

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.

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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.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	P5O1	P5O2
CO1	3	3	-	1	3	1	1	1	2	1	-	3	1	1
CO2	3	3	-	1	3	1	1	1	1	1	-	3	1	1
CO3	3	3	3	3	2	2	1	1	1	1	1	3	1	2
CO4	3	3	3	3	3	1	2	1	1	1	1	3	1	1
CO5	3	3	3	3	3	2	1	1	1	1	1	3	1	2
CO6	3	3	3	3	3	3	2	3	1	2	1	3	1	2

1 - Slightly; 2 - Moderately; 3 - Substantially

Text & Reference Books:

1. Theory of Machines by Rattan, SS; TMH full detail of publication
2. Theory of Machine by Norton, RL; TMH
3. Theory of Machine by Ballaney, 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, Thomas; Pearson/ CBS PUB Delhi.
7. Mechanism and Machine Theory by Rao, JS and Duggipati; New Age Delhi.
8. Theory of Machines by Lal, Jagdish; Metropolitan Book Co; Delhi -
9. Theory of Mechanisms & Machines by Ghosh, A., Mallik, AK; Affiliated East West Press, Delhi.

NPTEL Link for Kinematics of Machines

<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 Coriolis'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.

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3120333: Metal Cutting and Machine Tools

Category	Title	Code	Credit: 3			Theory Paper
Departmental Core-DC	Metal Cutting and Machine Tools	3120333	L	T	P	Max.Marks-50 Duration-2 hrs.
			3	-	-	

Course Objectives: To make the students understand:

1. The fundamental knowledge and principles in material removal processes.
2. The fundamentals and principles of metal cutting to practical applications through
3. The fundamentals of machining processes and machine tools.

Syllabus

Unit-I Mechanics of Metal Cutting: Introduction to manufacturing and machining, Classification of metal removal processes, Geometry of single point cutting tool and tool angles. Tool nomenclature. Conversion of tool angles from one system to another, Mechanics of chip formation and types of chips, chip breakers. Orthogonal and oblique cutting, cutting forces and power required, theories of metal cutting. Thermal aspects of machining and measurement of chip tool interface temperature. Friction in metal cutting. **Machinability & Cutting Fluids:** Concept and evaluation of machinability, tool life, mechanism of tool failure, tool life and cutting parameters, machinability index, factors affecting machinability. Advanced Cutting Tool Materials, Cutting Fluids

Unit-II General Purpose Machine Tool: Constructional detail of milling, shaper and planer machines. Tooling, attachments and operations performed, selection of cutting parameters, calculation of forces and time for machining. Broaching operation. Capston and turret Lathes, single and multiple spindle automates, operations, planning and tool layout.

Unit-III Abrasive Processes & surface Finishing: Abrasive, natural and synthetic, manufacturing nomenclature. Selection of grinding wheels, wheel mounting and dressing. **Surface Finish:** Elements of surface roughness, evaluation and representation and measurement of surface roughness, relationship of surface roughness to production methods.

Unit-IV Gear Manufacturing Processes: Introduction, materials, methods of gear manufacturing. Gear Milling, Gear Hobbing & Gear Shaping Machine Tools and processes. Modern gear manufacturing methods, gear inspection.

Unit-V Non-Conventional machining: Benefits, general application and survey of Non-conventional machining processes. Mechanism of metal removal, tooling and equipment and specific applications of EDM, LBM, EBM, ECM, USM, AJM, WJM, AWJM, PAM processes

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

- CO1: apply cutting mechanics to metal machining based on cutting force and power consumption.
- CO2: operate lathe, milling machines, drill press, grinding machines, etc.
- CO3: select cutting tool materials and tool geometries for different metals.
- CO4: choose appropriate machining processes and conditions for different metals.
- CO5: optimize parameters for material removal in unconventional machining processes.
- CO6: identify the process parameters, their effect and applications of different processes

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Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	1	3	1	1	1	2	1	-	3	1	1
CO2	3	1	2	2	3	1	1	1	1	1	-	3	1	1
CO3	3	3	3	2	3	2	1	1	1	1	2	3	1	2
CO4	3	3	3	2	3	1	2	1	1	1	2	3	1	2
CO5	3	3	3	3	3	2	1	1	1	1	2	3	1	2
CO6	3	3	3	3	3	3	2	3	1	2	2	3	1	2

1 - Slightly; 2 - Moderately; 3 - Substantially

Text Books

1. Fundamentals of Metal Cutting and Machine Tool by Boothroyd Geafery; McGH, Kogakuha Ltd.

2. Production Technology by Jain, R.K. and Gupta, S.C; Khanna Publishers.

Reference Books:

1. Workshop Technology by Chapman, Volume I, II, & III, ELBS.

2. Production Technology by HMT; McGraw Hill, New Delhi.

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**3120334: Fluid Mechanics and Hydraulic Machines**

Category	Title	Code	Credit-4			Theory Paper
Departmental Core-DC	Fluid Mechanics and Hydraulic Machines	3120334	L	T	P	Max.Marks-50 Duration-2hrs.
			2	1	2	

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 behavior and their merits and demerits

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	P%O1	P%O2
CO1	3	1	1	1	3	1	1	1	2	1	-	3	-	-
CO2	3	3	1	2	3	1	1	1	1	1	-	3	-	-
CO3	3	3	3	3	2	2	1	1	1	1	1	3	-	-
CO4	3	3	3	3	3	2	2	2	2	1	1	3	1	1
CO5	3	3	3	3	3	2	1	2	1	1	1	3	1	2
CO6	3	3	3	3	3	3	2	3	2	2	1	3	1	2

1 - Slightly; 2 - Moderately; 3 - Substantially

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.

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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.

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3120335: Software Lab

Category	Title	Code	Credit-1			Practical End Sem
Departmental Lab Core-DLC	Software Lab	3120335	L	T	P	Max.Marks-40 Min.Marks-13
			-	-	2	

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

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	3	1	1	1	1	1	1	3	1	1
CO2	3	3	1	1	3	1	1	1	1	1	1	3	1	1
CO3	3	3	3	3	3	1	1	2	1	2	1	3	1	1
CO4	3	3	2	3	3	1	1	2	1	2	1	3	1	1
CO5	3	3	3	3	3	3	1	2	1	2	1	3	2	3
CO6	3	3	3	3	3	3	2	2	1	2	1	3	2	3

1 - Slightly; 2 - Moderately; 3 - Substantially



Text Books and Reference books:

1. Franke & Roger: Modelling and simulation for chemical engineering, Wiley Interscience
2. Luyben: Process modelling simulation and control for chemical engineers, 11nd, 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.

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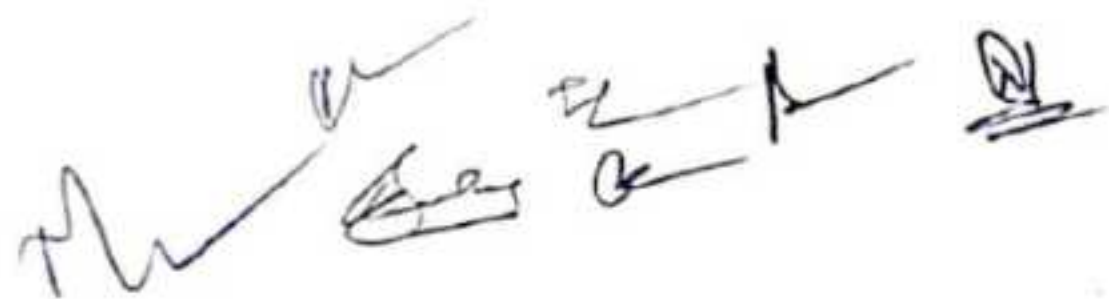
Item ME16	Propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered in the <i>B.Tech .III Semester (for batches admitted in 2023-24)</i> in online mode under <i>Self-Learning/ Presentation</i> .
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26/11/23



Self-study courses-III Sem (July-Dec 2024)

S.No.	Name of Subject	Code	Week
1.	Manufacturing Processes - Casting And Joining	3120336 (i)	4
2.	Understanding Design	3120336 (ii)	4
3.	Product Design and development	3120336 (iii)	4





3120336: Manufacturing Processes - Casting and Joining

Category	Title	Code	Credit - 1			Internal Evaluation
Self-study courses (i)	Manufacturing Processes - Casting And Joining	3120336	L	T	P	PPT presentation/ Report Writing
			-	-	2	

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_me84/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22/07/2024	16 Aug 2024	22 Sep 2024	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



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

Deemed to be university

Department of Mechanical Engineering

3120336: Understanding Design

Category	Title	Code	Credit - 1			Internal Evaluation
Self-study courses (ii)	Understanding Design	3120336	L	T	P	PPT presentation/ Report Writing
			-	-	2	

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_de11/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22/07/2024	16 Aug 2024	22 Sep 2024	4 Weeks

Course layout

Week 1 :

Module 1- An Introduction to Design,

Module 2- Users and Context

Week 2 :

Module 3-Design and Society,

Module 4 - Design and Sustainability

Week 3 :

Module 5 - Design and Industry,

Module 6 - Design and collaboration

Week 4 :

Module 7 - Innovation by Design

Books and references

1. Ansell, C & Torfing J (eds) (2014). Public Innovation through Collaboration and Design. London and New York: Routledge.
2. Antonnelli, Paola (2005). Humble Masterpieces: everyday marvels of Design. Harper Collins Publishers.
3. Baxter, Mike (1995). Product Design. London Glasgow New York: Chapman & Hall.
4. Brown, Dan M (2013). Designing Together. New Riders.
5. Doordan, Dennis (ed) (2000). Design History: An Anthology. Cambridge, London: MIT Press.
6. Heskett, John (2002). Design: a very short introduction. Oxford University Press.
7. Geist, Valerius (1978). Life Strategies, Human Evolution, Environmental Design: towards a biological theory of health. New York, Heidelberg, Berlin: Springer-Verlag.
8. Lawson, Brian (2006). How Designers Think: The design process demystified. Routledge.
9. Highmore, Ben (ed) (1975). The Design Culture Reader. London and New York: Routledge.

3120336: Product Design and development

Category	Title	Code	Credit - 1			Internal Evaluation
Self-study courses (iii)	Product Design and development	3120336	L	T	P	PT presentation/ Report Writing
			-	-	2	

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_me81/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22/07/2024	16 Aug 2024	22 Sep 2024	4 Weeks

Course layout

Week1: Introduction to course, Product life-cycle, Product policy of an organization. Selection of a profitable product, Product design process, Product analysis.

Week 2: Value engineering in product design; Advantages, Applications in product design, Problem identification and selection, Analysis of functions, Anatomy of function. Primary versus secondary versus tertiary/unnecessary functions, Functional analysis: Functional Analysis System Technique (FAST), Case studies.

Week 3: Introduction to product design tools, QFD, Computer Aided Design, Robust design, DFX, DFM, DFA, Ergonomics in product design,.

Week 4: DFMA guidelines, Product design for manual assembly, Design guidelines for metallic and non-metallic products to be manufactured by different processes such as casting, machining, injection molding etc., Rapid prototyping, needs, advantages, working principle of SLA, LOM and SLS

Books and references

Nil

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

Deemed to be university

Department of Mechanical Engineering

3120336: Product Design and development

Category	Title	Code	Credit - 1			Internal Evaluation
Self-study courses (iii)	Product Design and development	3120336	L	T	P	PT presentation/ Report Writing
			-	-	2	

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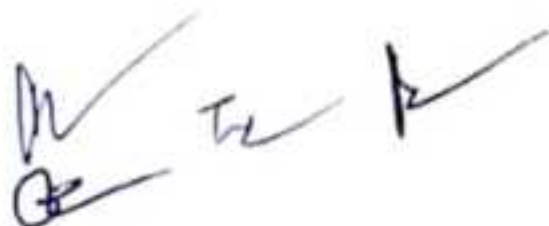
Week 2: Value engineering in product design; Advantages, Applications in product design, Problem identification and selection, Analysis of functions, Anatomy of function. Primary versus secondary versus tertiary/unnecessary functions, Functional analysis: Functional Analysis System Technique (FAST), Case studies.

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Books and references

Nil



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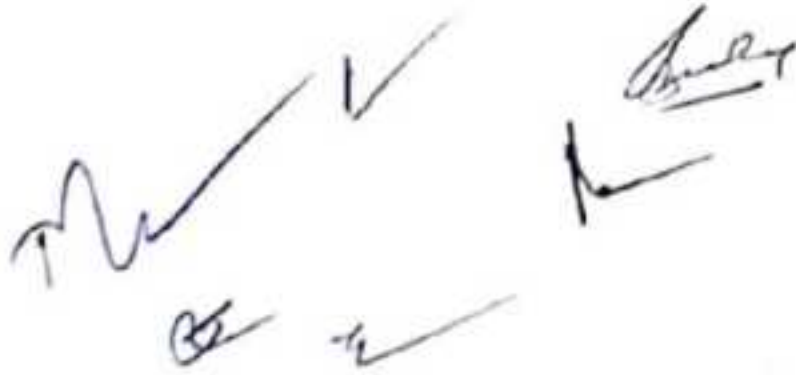


MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
 Department of Mechanical Engineering
 Scheme of Evaluation

Master of Technology (Production Engineering) (Semester III)
 Scheme of Examination

S.No	Subject Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week		Total Credits
			Theory Slot			Practical Slot		Viva/Viva					
			End sem	Mid sem	Quiz/ Assignment	End Sem Practical Viva	Seminar/ Work/ Practical Record/ Assignment/ Quiz/ Presentation	Assignment	Exam				
1	Chem 1	Dissertation Part I (Compulsory Part)	-	-	-	150	100	-	-	250	-	12	-
2	Chem 2	Dissertation Part II (Elective Part)	-	-	-	-	-	24	74	12	-	12	
Total			-	-	-	150	100	24	74	260	-	12	12

Item ME17 a	To discuss and recommend the scheme structure & syllabi of PG Programme (M.E./M.Tech./MCA/MBA) along with their Course Outcomes (COs)
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Computational Techniques

Category	Title	Code	Credit-3			Theory Paper
DC-1	Computational Techniques		L	T	P	
			3	-	-	

Objective of Course

1. To know about the formulation of L.P.P. & its solution
2. To explore the Game theory
3. To describe Probability and random Process
4. To describe random sampling and hypothetical test
5. To perceive the Z-transform techniques

Syllabus

Unit- I: Concept of LPP, LPP formulation, Graphical method for solving LPP with two variables, Simplex method, Duality theory, Transportation and Assignment problems. Non Linear Programming Problems (NLPP): Introduction of NLPP, constraints and non constraint problems of maxima and minima, constraints in the form of equations, Dynamic Programming: Basic concepts, Bellman's optimality principle, dynamic programming approach in decision making problems, optimal subdivision problems.

Unit- II: Introduction, competitive games, finite and infinite games, two person zero sum game, pure and mixed strategies, saddle point, maximin and minimax principle, solution of a rectangular game in terms of mixed strategies, Graphical method of (2xm) and (nx2) games.

Unit- III: Theory of Probability: Concept of probability, Random variable, discrete probability distribution, Continuous probability distribution, Moment generating function, Probability density function, some special distribution, Random Variable: Concept of Random variable, one dimensional Random variable, two dimensional, distribution function, Joint probability distribution function, Marginal probability distribution, cumulative probability distribution.

Unit- IV: Testing of Hypothesis, Origin of the theory of sampling, chi-square (χ^2) distribution, the t-distribution, Fisher's Z-distribution, student-distribution, Analysis of variance one way classification, two-way classification.

Z-transform and their properties, inverse Z-transform, convolution theorem, solution of difference equations by Z-transform. Basic concept of Bessel's function, Hankel transform and their properties, Parseval's theorem.

Course Outcomes After completing this course, the students will be able to:

CO's	Description of CO's
CO1	Determine the solution of Linear and Non Linear Programming Problems
CO2	Evaluate the problems related to game theory.
CO3	Acquire the knowledge of Probability theory and Random Variable.
CO4	Analyze the test of hypothesis and Analysis of Variance.
CO5	Identify the concept of transform.

Recommended Books:

1. I. Griva, S. G. Nash and A. Sofer: Linear and Non Linear Optimization, Society for Industrial & Applied, U. S. Mathematics , 2012.
2. F. B. Hildebrand: Methods of Applied Mathematics , Prentaince Hall, 1992.
3. H. C. Saxena: Mathematical Statistics, S Chand, 1986.
4. H. K. Dass: Advance Engineering Mathematics, S. Chand, 2018.
5. P. R. Thie and G. E. Keough: An Introduction to Linear Programming & Game Theory, Wiley India Private limited, 2008

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Production Engineering- I

Category	Title	Code	Credit-3			Theory Paper
Departmental Core-DC-2	Production Engineering- I		L	T	P	
			3	-	--	

Course Objective: To make the student to understand:

- the basic principles and methods utilized in the joining and welding technology of engineering materials
- how to handle welding equipment and weld/join materials practically
- how to analyze, implement and maintain manufacturing system
- methods of metal casting, casting defects and Gating system
- methods of Moulding process, pattern design

Syllabus

Unit-I Introduction: - Metal casting vis-a-vis other processes, casting problems, design and introduction of moulds, melting, refining and pouring and liquid metal. Mechanism and Rate of Solidification on Metals and Alloys: - Nucleation and growth in pure metals and alloys, Solidification, Solidification in actual castings, feeding resistance, rate of solidification.

Unit-II Riser Design and Placement: - Riser designs chvorinov's caines, NRL methods, placement of risers, effects of complex section and chills, case studies. Gating Design: - Gating principles, vertical gating, aspiration effects and its prevention, bottom gating system, horizontal-gating system, and case studies.

Unit-III Mould Production and Pattern Design: - Conventional moulding and core making processes, new moulding processes viz. Cold box, hot box, and vacuum moulding etc. pattern design considerations.

Die-Castings: - Recent trends, recasting, shell, lined die casting, ferrous die-casting. Non Mould materials and mould metal reactions: Structure of silica clay, various types of bonds, mould metal reactions, recent trends such as sand deformability index, role of atmospheres etc. Casting Design Considerations and Casting Defects: - Various casting design factors, casting defects, their causes and remedies.

Unit-IV Welding Technology: - Welding as compared with other fabrication processes, classifications of welding processes, fusion and pressure welding processes, weld-ability of metals, and metallurgy of welding. Weld design, stress distribution and temperature fields in the welds. Metal transfer and melting rate, recent developments in welding, explosive welding, laser beam welding, radio frequency induction welding etc. Specific application of welding e.g. cladding, metallizing, surfacing and fabrication.

Unit-V Welding of plastics, welding defects and inspection of welds, thermal cutting of metals, processes used for thermal cutting of metals. Recent developments in thermal cutting processes, cutting of cast iron, stainless steel and non-ferrous metals. Use of thermal cutting in fabrication of process machines and pressure vessels etc. Economics of welding: welding cost, productivity, post welding operations, standard time for welding & flame cutting, standard time & cost calculations.

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

1. Describe the causes of welding defects and how it can be prevented.
2. Use the basic manufacturing methods, measurements, automation and quality control.
3. Apply the principles of metallurgy during the welding process.
4. Demonstrate safe work habits that reflect concern and care for self, others and the environment.
5. Employ the principles of Moulding, casting and Gating design.
6. Perform any of the metal joining techniques (welding, brazing and soldering) conveniently

Text & References Books:

1. Welding Processes & Technology - Dr. R. S. Parmar, Khanna Publishers, New Delhi
2. Production Technology - R. C. Patel & C. G. Gupte, (Vol III) C. Jammadas & Co. Mumbai
3. Welding Technology & Design - V. M. Radhakrishnan, Newage International (P) Ltd, Pub. N. Delhi
4. Welding Skills & Technology - Dave Smith, Gregg Division, MCGRAW-Hill Book Company
5. Welding Handbook, Seventh Edition, Vol-I, Welding Processes - Arc and Gas Welding and

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Maintenance Management

Category	Title	Code	Credit-3			Theory Paper
Departmental Core(DC)-3	Maintenance Management		L	T	P	
			3	-	--	

Course Objectives: To make the student to understand:

1. To learn the Maintenance Management, Maintenance Planning and Scheduling, Computerized Maintenance Management Systems
2. To learn the Maintenance Organization Structure and Policies
3. To understand the Controlling Maintenance Costs, Life Cycle Cost Concepts
4. To learn the Optimizing Spare Parts Inventory Levels and Total Productive Maintenance Concepts.
5. To learn the overall configuration and Maintenance of Production Machines, Manufacturing System.

Syllabus

Unit-I Introduction, Requirements: - Maintenance Engg., Maintenance Management, Types of Maintenance. Break down, Preventive, Predictive, Routine, continuous Schedule. Maintenance contract, Contract Act, Repair, Activity, Operating Practices to reduce Maintenance. Issues, Problems, Selection of System, Renovation, Addition, Restoration & Control.

Unit-II Maintenance Organisation: - Function, Layout, Centralized and Decentralized Maintenance, Incentives, Human Factors, Maintenance of Plant, Pre-requisites, Programmes, Strategies, Policies.

Unit-III Work Measurement in Maintenance: - Work Authorization and Contract, Rating and Evaluation, Work simplification, Estimation of Repair and Maintenance cost. Cost control for efficient operation, Small Plant Maintenance Control.

Unit-IV Maintenance Store & Inventory Control: - Store Room Materials & Standard Spares, Spares Management, Introduction to computer in Maintenance, Automation Maintenance, Information by computers, Computerized Planning and scheduling, Total Productive Maintenance: Activities, Planned Maintenance, Autonomous Effects, Evaluation Organizations, Maintenance, Aims, Steps, Total Preventive Maintenance, Zero Break down.

Unit-V Maintenance of Production Machines: - Lath m/c, Drilling m/c, Milling m/c, Welding m/c, Shaper.

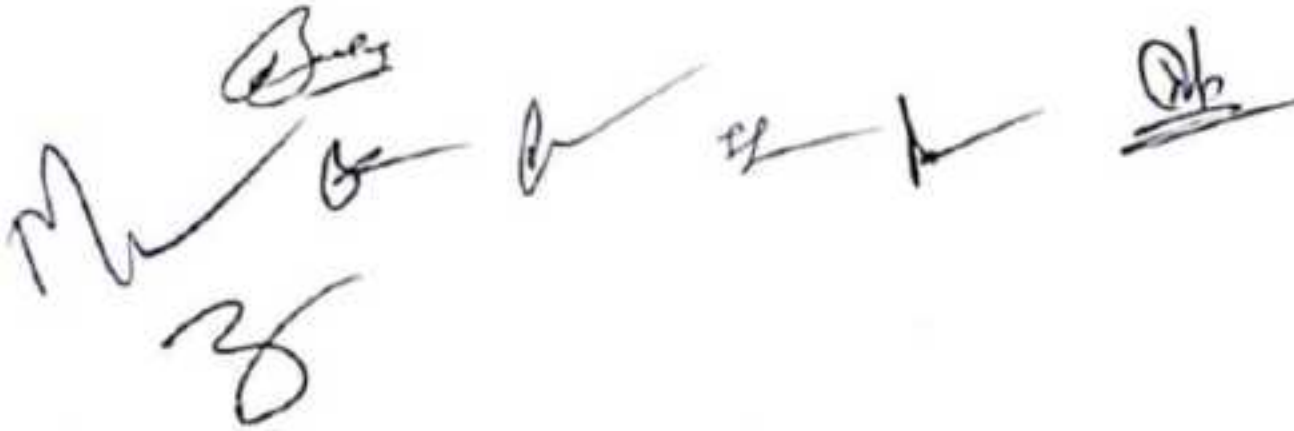
Course outcomes: After successful completion of this course students will be able to:

1. State Maintenance Key Performance Indicators
2. Use a preventive maintenance plan and monitor its implementation and review of technical reports.
3. Select highest quality of production and the continuation of the workflow.
4. Implement team based continuous Improvement in Maintenance
5. Apply knowledge about Managing Maintenance Spare Parts and Logistics

6. Perform maintenance orders issued by the in charge, implemented and completed in the promised time for him and to make sure the machine is clean after the maintenance process.

Text & References Books:

1. Bikash Bhadury. "Total Productive Maintenance". Allied Publisher Ltd. New Delhi.
2. BC langlay. "Plant Maintenance". Prentice-Hall International. New Jersey.
3. JD Pattern. Jr. "Maintainability and Maintenance Management". Instrument society of America, third edition.
4. P Gopalakrishnan and AK Banerji, "Maintenance and Spare Parts Management". Prentice-Hall of India (P) Ltd. New Delhi.

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: Flexible Manufacturing System

Category	Title	Code	Credit-3			Theory Paper
Departmental Elective (DE)-I	Flexible Manufacturing System		L	T	P	
			3	-	--	

Course objectives: To make the student to understand:

1. Different types of manufacturing available today such as the Special manufacturing System, the Manufacturing Cell and the Flexible Manufacturing System
2. Material handling system, Cutting tools and tool management
3. Fundamentals of computer assisted numerical control programming and automated storage systems
4. Concept of Aggregate planning, single stage planning and multi stage planning
5. Common CAD/CAM data base organized to serve both design and manufacturing

Syllabus

Unit-I Introduction of CAD/CAM systems. Overview of FMS. System hardware and general functions.

Unit-II Material handling systems and automated storage/retrieval systems. Work holding system. Cutting tools and tool management.

Unit-III Physical planning of system, Aggregate Planning. Single stage planning & Multi stage planning.

Unit-IV Software structure functions and description. Cleaning and automated inspection. Communications and computer networks for manufacturing.

Unit-V Quantification of flexibility. Human factors in manufacturing. FMS and CIM in action. Justification of FMS. Modelling for Design. Planning and operation of FMS.

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

1. Define various workstations, system support equipments
2. Identify hardware and software components of FMS
3. Familiarized with single stage planning & multi stage planning
4. Implement planning and scheduling methods used in manufacturing system
5. Summarize the concepts of modern manufacturing such as JIT, supply chain management and lean manufacturing
6. Perform simulation on software's use of group technology to product classification

Text & References Books:

1. Mikell P. Groover, Automation, Production Systems and CIM. "PIII
2. Greenwood, "Implementation of FMS", MacMillan Edition.
3. Talavage J. "FMS in Practice, Applications, design and Simulation", Marcel Dekker Inc.
4. Ranky P.O. "Design and Operation of FMS", IPS Publications, UK.

Ergonomics and Work Study

Category	Title	Code	Credit-3			Theory Paper
Departmental Elective (DE)-1	Ergonomics and Work Study		L	T	P	
			3	-	-	

Course Objective: To make the students to understand:

1. Concept and significance of work study and ergonomics.
2. Various techniques of work-study for improving the productivity of an organization.
3. Existing methods of working on the shop floor of an organization.
4. Allowances, rating, calculation of basic and standard time for manual operations in an organization.
5. Work place design, working postures and lifting tasks.

Syllabus

Unit -I Human being in Man Made World, Gross Human Anatomy, Anthropometrics, Static and Dynamic, Muscles and Work Physiology, Static and Dynamic Work including Maximum Capacity.

Unit-II Biomechanics, Environmental Condition including Thermal, Illumination Noise and Vibration, Biological Transducer and Nervous system including their Limitations. Control and Displays Psycho Physiological aspects of Design. Research Techniques in Ergonomics .Generation. Interpretation and application as statistical Methods. Case Analysis

Unit-III Method Study: - Selection of Problem, Application of critical examination techniques. Preparation of work Study Reports, Development of improved methods, preparation for and presentation of improved methods, implementation of improved methods, follow-up techniques and report.

Unit-IV Work Measurement: - Work Sampling. Fundamental statistical concepts sample size, procedure for making a work sampling study, determining time standards by work sampling, practical applications, advantages and disadvantages.

Unit-V Micro Motion Study. PMTS. MTM Systems work factor system and Production Incentives

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

1. Identify potential and current OH&S hazards in the workplace relating to ergonomics issue.
2. Describe relation between human motion and industry.
3. Calculate the production capacity of man power of an organization.
4. Analyze the level of risk in a job causing stress, fatigue and musculoskeletal disorders and design appropriate work systems.
5. Devise appropriate wage and incentive plan for the employees of an organization.
6. Design physical and psychosocial work system and work places.

Text & References Books:

1. Barnes Ralph M., "Motion & Time study: Design and Measurement of Work", Wiley Text Books, 2001.
2. Lakhwinder Pal Singh, "Work Study and Ergonomics" CAMBRIDGE, 2010.
3. S.K. Sharma Savita Sharma, "Work Study and Ergonomics" S K Kataria and Sons 2006.
4. P.C.Tiwari, "Work Study and Ergonomics" CRC Press, 2004.

5. Suresh Dalela and Saurabh Dalela, "Work Study and Ergonomics" CRC Press, 2001.
6. Marvin E. Mundel & David L. "Motion & Time Study: Improving Productivity", Pearson Education, 2000.
7. Benjamin E. Niebel and Freivalds Andris, "Methods Standards & Work Design", Mc Graw Hill, 1997.
8. Work Study-Shan
9. Work Study - Sharma

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: Total Quality Management

Category	Title	Code	Credit-3			Theory Paper
Departmental Elective (DE)-1	Total Quality Management		L	T	P	
			3	-	--	

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

Syllabus

Unit-I Introduction to ISO 9000 and TQM: - Quality, History of Quality, Total Quality, TQM, TQM Enablers, TQM Models, Quality Control, Computer Aided Quality Control, Customer Satisfaction, Customer Drives, Quality Circles, Customer Complaints, Types of Customers, Customers, Surveys.

World Class Quality Control: - Total Waste Elimination, Waste identification, Total Employees involvement, TEI Practice, Company wide quality control.

Unit-II TQM Gurus: - Deming, Juran, Crosby, Feighbaum, Ishikawa, Quality Assurance, Principles, forms, at different stages. Quality Assurance: - QA Programme, QA and top Management, QA department, Vendor rating

Unit-III Quality of Product Design and Development: - Methods for design and development, Integrated Product development, Quality of conformance, computer aided manufacturing quality. Next Generation: - Quality control in manufacturing, Quality improvement: Juran 7 Quality tools, Benchmarking, types, Process, Quality leadership for TQM, TQM Implementation:- Juran Approach, Quality Organization Requirements, planning of quality organization.

Unit-IV Quality Manual for ISO 9000-2000: - QMS guideline, Management responsibility, Resource Management, Process Management, Measurement Analysis and Improvement.

Quality Cost: Evolution: - Time and Quality cost, Activity based costing, Quality cost collection, Quality cost analysis, Juran classical model for optimum quality levels.

Unit-V Quality Awards: - ISO Malcolm Baldrige National quality award, European quality awards, CH, EXIM award. ISO 14001 environment manual, ISO 18001 manual

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

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Computer Integrated Manufacturing

Category	Title	Code	Credit-3			Theory Paper
Specialization Course (SC-1)	Computer Integrated Manufacturing		L	T	P	
			3	-	--	

Course objectives: To make the student to understand:

1. To use computers in the area of manufacturing to reduce manual processing and linking computers to all the manufacturing machines and increase the productivity, reduce the unnecessary costs.
2. To learn the computer numerical control, retrofitting of conventional machine tools, programming and feedback systems.
3. To understand the different controlling system, sensors and work holding devices.
4. To learn the CNC part programming, cost of machining operations and maintenance features.
5. To learn the overall configuration and Computerized Manufacturing Planning System.

Syllabus

Unit-I Production Operations & Automation Strategies: - Automation Defined, Types of Production Systems, Production Concepts and Mathematical Model, Automation Strategies, Fundamentals of CAD/CAM/CIM.

Unit-II Numerical Control Production System: - Types of NC Systems, MCU and other components of NC System, Applications, NC-Part Programming, (Manual & Computer Assisted) APT Language, Computer-Automated Part Programming, DNC, CNC, and Adaptive Control.

Unit-III Group Technology & Flexible Manufacturing Systems: - GT Part Families, Classification & Coding, M/C Cell Design, Benefits of GT, FMS Workstations, Material Handling & Storage Systems, Computer Control System, Planning of FMS Analysis Methods.

Unit-IV Industrial Robotics: - Robotics Technology, Programming & Applications.

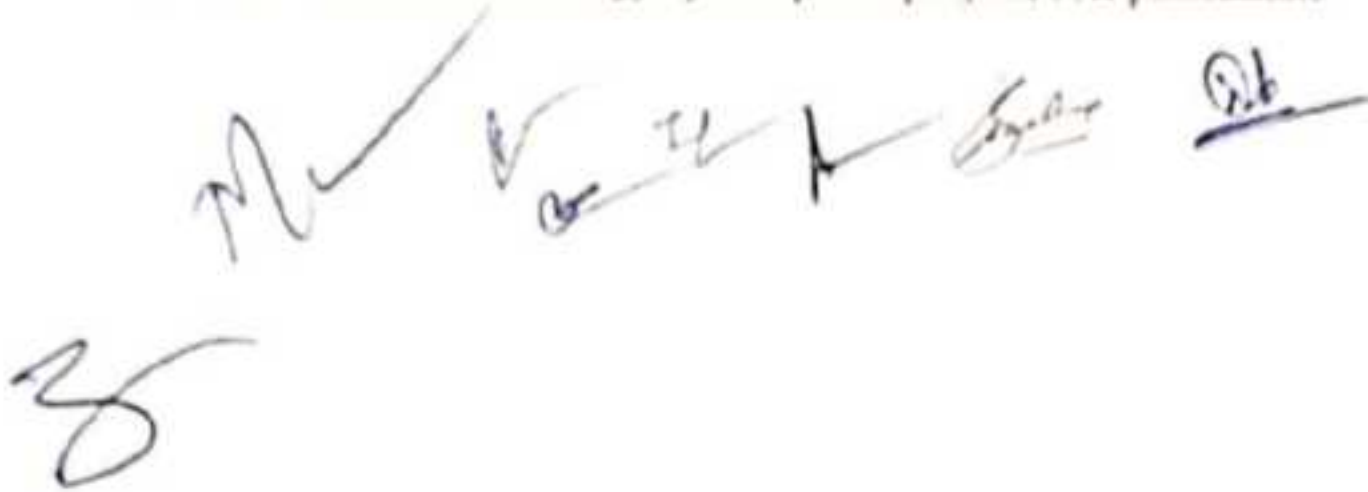
Unit-V Computerized Manufacturing Planning System: - Computer Aided Process Planning, Computer Integrated Production Planning Systems, Shop Floor Control.

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

1. **Identify** the main elements of computer numerical control manufacturing systems.
2. **Discuss** knowledge about constructional features of CNC machine and Retrofitting of Conventional Machine Tools.
3. **Apply** control system, feedback devices, sensors and tooling in manufacturing processes.
4. **Arrange** the different machining operations in a program by using various codes and languages.
5. **Determine** the cost of machining operation of CNC and monitoring the various features to enhance the life span of the machine.
6. **Create** Process product models with CAM tools and CNC machines.

Text & References Books:

1. Automation, Production system and computer integrated manufacturing by M.P. Groover, PHI
2. CAD/CAM by P. N. Rao, P. N. Rao, Tata McGraw Hill publication
3. CAD/CAM/CIM by Bhupendra Gupta, Dhanpat Rai publication
4. Computer control of machine tools by Koren Yoram, Tata McGraw Hill publication
5. Manufacturing Engineering and Technology by Serope Kalpakjian, PHI publication

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Item ME19	To review the CO attainments, to identify gaps and to suggest corrective measures for the improvement in the CO attainment levels for all the courses taught during July-Dec 2023 session.
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Mechanical CO Attainment July-Dec 2023

3rd Semester Mechanical Engg. (B. Tech)			Indirect CO Attainment (Through Feedback)						Direct CO Attainment (Through Exams)						Total CO Attainment (20% Indirect + 80% Direct)					
Subject Code	Subject Name	Faculty VC	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6
			2.28	2.79	2.61	2.44	1.84	1.88	2.32	2.11	2.45	2.46	1.95	1.97	2.31	2.25	2.48	2.46	1.93	1.97
1200325	Engineering Mathematics-II	IJAC Department	2.61	2.54	1.80	1.87	1.92	2.09	2.64	1.91	1.93	1.96	2.19	2.43	2.63	2.04	1.90	1.94	2.14	2.36
1200331	Mechanics of Materials	Dr. D K Rathore	2.64	2.63	2.75	2.48	2.55	2.40	2.51	2.19	2.62	2.34	2.61	1.80	2.54	2.28	2.65	2.37	2.60	1.99
2120332	Theory of Machines -I	Prof. A S Rajput	2.62	2.12	2.72	2.50	2.37	2.15	2.17	2.08	2.46	2.69	1.82	2.23	2.26	2.09	2.51	2.67	1.93	2.21
2120333	Metal Cutting and Machine Tools	Dr. S K Chourasiya	2.07	1.82	2.61	2.43	2.44	2.40	2.75	2.41	2.38	2.17	2.60	1.55	2.61	2.29	2.43	2.23	2.57	1.96
2120334	Fluid Mechanics and Hydraulic Machines	Prof. B Pandey	2.21	2.29	1.97	2.75	2.75	2.56	2.60	2.17	2.37	2.22	1.90	1.93	2.52	2.19	2.29	2.33	2.07	2.06
2120335	Software lab	Prof. S Agarwal and Dr. Gavendra	2.04	2.37	1.90	2.00	2.11	2.49	2.78	2.69	2.37	2.29	2.14	2.32	2.63	2.63	2.28	2.08	2.22	2.04
2120336	Self-learning/Presentation (SWAYAM/NPTEL/MOOC)	Dr. S K Chourasiya and Dr. G No	2.50	2.72	2.53	2.22	2.77	1.83	2.19	2.56	1.89	2.34	1.97	2.11	2.25	2.59	2.02	2.32	2.13	2.05
2120331(P)	Mechanics of Materials lab	Dr. D K Rathore	2.31	2.66	2.48	1.82	2.24	2.34	1.98	2.05	2.70	2.15	2.22	1.96	2.05	2.17	2.66	2.08	2.22	2.04
2120332(P)	Theory of Machines -I lab	Prof. A S Rajput	2.75	2.35	1.87	2.41	2.19	2.76	2.01	2.12	2.77	1.93	2.38	2.33	2.16	2.17	2.59	2.03	2.34	2.42
2120334(P)	Fluid Mechanics and Hydraulic Machines lab	Prof. B Pandey	2.56	2.10	2.77	2.44	1.88	1.84	2.19	2.33	2.29	2.66	2.78	2.09	2.26	2.28	2.39	2.62	2.60	2.04
1000005	Project management and financing	Dr Vedansh Chaturvedi	1.83	2.45	2.73	2.61	1.88	2.32	2.42	2.16	2.08	1.98	1.98	1.95	2.31	2.22	2.21	2.11	1.96	2.02
3000001	Engineering Physics																			
5th Semester Mechanical Engg. (B. Tech)			Indirect CO Attainment (Through Feedback)						Direct CO Attainment (Through Exams)						Total CO Attainment (20% Indirect + 80% Direct)					
Subject Code	Subject Name	Faculty VC	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6
			2.23	2.75	2.65	2.48	2.08	2.03	2.69	2.56	2.74	2.28	1.93	1.91	2.60	2.60	2.72	2.32	1.96	1.93
120519	Data Science	Prof. A S Rajput	2.28	1.88	2.41	1.98	1.99	2.04	2.71	2.29	1.99	1.85	2.29	1.85	2.62	2.21	2.07	1.88	2.23	1.89
120520	Theory of Machines -II	Dr. Jyoti Vimal																		
120511	Industrial Engineering	Dr. Nitin Upadhyay	2.21	2.78	2.43	2.28	1.98	1.87	1.96	2.42	2.60	2.37	1.96	1.80	2.01	2.49	2.57	2.35	1.96	1.86
120513	Heat and Mass Transfer	Dr. M K Gaur	2.60	2.17	2.29	2.16	1.87	2.16	1.88	2.39	2.47	2.00	2.19	2.47	2.02	2.35	2.43	2.03	2.13	2.41
120515	Machine Design	Dr. D K Rathore	2.04	2.34	2.55	2.40	2.02	2.45	2.53	2.33	2.15	1.83	2.19	1.84	2.43	2.33	2.23	1.94	2.16	1.96
120516	Minor Project-I		2.30	1.85	2.60	2.55	2.64	1.97	1.93	2.09	2.10	2.58	2.75	2.60	2.00	2.04	2.20	2.57	2.73	2.47
120517	Self-learning/Presentation (SWAYAM/NPTEL/MOOC)	Dr. S K Chourasiya and Prof. V C	2.66	2.08	1.92	1.87	2.49	2.33	2.13	2.57	2.43	2.49	2.25	2.30	2.24	2.47	2.33	2.37	2.30	2.31
120519(P)	Data Science lab	Dr. Jyoti Vimal	2.32	1.85	2.34	2.05	2.26	2.30	2.19	2.55	2.48	2.76	2.12	2.35	2.22	2.41	2.45	2.62	2.15	2.34
120520(P)	Theory of Machines -II lab	Dr. Nitin Upadhyay	2.53	2.47	1.93	2.53	2.62	2.62	2.12	2.16	2.33	2.72	2.76	2.61	2.20	2.22	2.26	2.68	2.73	2.61
120513(P)	Heat and Mass Transfer lab	Dr. M K Gaur	2.38	1.81	2.30	2.69	2.61	2.08	2.39	2.11	2.12	1.93	2.62	2.07	2.39	2.05	2.16	2.03	2.62	2.07
120515(P)	Machine Design lab	Dr. D K Rathore	2.44	2.76	2.19	2.60	2.03	2.02	2.14	2.79	2.47	2.49	2.27	2.09	2.20	2.68	2.41	2.51	2.22	2.08
1000006	Disaster Management	Dr. G Norkey	2.42	2.50	1.98	2.44	2.16	2.66	2.71	2.42	2.28	2.07	2.20	1.95	2.55	2.44	2.22	2.14	2.19	2.10
7th Semester Mechanical Engg. (B. Tech)			Indirect CO Attainment (Through Feedback)						Direct CO Attainment (Through Exams)						Total CO Attainment (20% Indirect + 80% Direct)					
Subject Code	Subject Name	Faculty VC	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6
			2.05	2.02	1.83	2.28	2.64	1.85	2.65	2.25	2.21	2.39	1.86	1.98	2.54	2.20	2.16	2.37	2.02	1.1
120731	Advanced Production Technology	Dr. Amit Aherwar	2.63	2.57	2.78	2.27	2.47	1.90	2.60	2.64	2.14	2.58	2.30	1.98	2.61	2.63	2.27	2.52	2.33	1.1
120732	Metrology, Measurement and Control	Dr. S K Chourasiya	2.57	2.74	2.27	2.10	2.41	2.12	2.56	2.27	2.59	2.10	2.25	1.87	2.56	2.36	2.53	2.10	2.28	1.1
120733	Total Quality Management	Prof. Sharad Agarwal	2.48	2.36	2.26	2.69	2.25	2.06	2.07	2.70	2.22	2.12	1.87	2.09	2.15	2.63	2.23	2.23	1.95	2.1
120715	Reliability and Vibration Lab	Prof. V Shrivhare	2.48	2.04	2.12	2.14	2.49	1.93	2.10	2.16	2.59	2.42	2.02	2.31	2.18	2.14	2.50	2.36	2.11	2.1
120717	Creative Problem Solving	Dr. S. K. Chourasiya																		
120761	Foundation of Computational Fluid Dynamics	Prof. Bhupendra Pandey	2.49	2.47	2.43	2.40	2.23	1.90	2.14	2.05	2.77	2.48	2.16	1.87	2.21	2.13	2.70	2.46	2.18	1.1
120762	Introduction to Composites	Dr. D K Rathore	2.37	2.29	2.74	1.97	2.20	1.97	2.57	2.32	1.93	1.87	2.54	1.97	2.53	2.31	2.09	1.89	2.47	1.1
120763	Advanced Machining Processes	Dr. S K Chourasiya	2.03	2.15	2.37	2.09	1.80	2.67	2.08	2.14	2.22	2.35	1.87	2.15	2.08	2.14	2.25	2.30	1.86	2.1
120754	Fundamentals Of Additive Manufacturing Technology	Dr. Gavendra Norkey	2.62	2.33	2.17	2.20	2.43	2.18	2.08	2.43	2.43	2.18	2.50	1.98	2.19	2.41	2.38	2.18	2.49	2.1
120765	Energy Conservation and Waste Heat Recovery	Prof. Sharad Agarwal	2.71	2.56	2.50	2.40	2.21	2.14	2.05	2.16	2.56	2.63	2.17	2.10	2.18	2.24	2.55	2.58	2.18	2.1
120766	Work system Design	Dr. Nitin Upadhyay	2.58	1.81	2.22	2.05	1.90	2.49	2.66	2.05	2.55	2.12	2.61	2.08	2.64	2.00	2.48	2.11	2.47	2.1

Item ME20	To review the PO attainments levels and suggest the actions to be taken for improvement in PO attainment
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16 Na Wa R

PO Attainment 2019-2023

B.E./B.Tech. Mechanical Engineering

S.No.	Subject Name and Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	Material Science(120301)	2.30	2.30	2.29	2.25		2.32	2.28	2.28	2.33	2.31		2.28		
2	Mechanics of Materials(120302)	2.33	2.30	2.32	2.26	2.22	2.29	2.29	2.26	2.24	2.18	2.29	2.29	2.26	2.27
3	Theory of Machines -I(120303)	2.14	2.14	2.13	2.14	2.13	2.12	2.20	2.17		2.22	2.16	2.15	2.16	2.06
4	Fluid Mechanics and Hydraulic Machines(120304)	2.31	2.12	2.32	2.14	2.35	2.14	2.52	2.32	2.32	2.46	2.45	2.31	2.36	2.26
5	Mechanics of Materials lab (120302 P)	2.29	2.28	2.28	2.23	2.29	2.28	2.20	2.21	2.22	2.31	2.25	2.29	2.20	2.21
6	Theory of Machines -I lab (120303 P)	2.30	2.30	2.32	2.31	2.30	2.30	2.37	2.23	2.28	2.22	2.27	2.29	2.31	2.26
7	Fluid Mechanics and Hydraulic Machines lab (120304 P)	2.25	2.25	2.25	2.24	2.23	2.24	2.21	2.12	2.23	2.23	2.33	2.34		
8	Software Lab (120305)	2.15	2.17	2.16	2.16	2.16	2.21	2.17	2.17	2.20		2.02	2.14	2.12	2.13
9	Theory of Machines -II (120401)	2.30	2.28	2.24	2.27	2.30	2.25	2.28	2.27	2.33	2.29	2.30	2.28	2.31	2.28
10	Design of Machine Elements(120402)	2.15	2.14	2.12	2.12	2.13	2.14	2.13	2.10	2.11	2.15	2.14	2.14	2.14	2.14
11	Manufacturing Process(120403)	2.25	2.25	2.26	2.25	2.27	2.23	2.23	2.25	2.28	2.29	2.27	2.25	2.25	2.25
12	Engineering Thermodynamics(120404)	2.31	2.28	2.27	2.39	2.34	2.14	2.28	2.32	2.42	2.35	2.35	2.40	2.35	2.49
13	Theory of Machines -II lab (120401 P)	2.23	2.25	2.24	2.25	2.23	2.24	2.24	2.23	2.23	2.27	2.24	2.24	2.24	2.22
14	Design of Machine Elements lab (120402 P)	2.30	2.30	2.31	2.30	2.30	2.29	2.30	2.29	2.30	2.32	2.32	2.32	2.30	2.30
15	Production lab (120405)	2.13	2.13	2.11	2.10	2.10	2.13	2.15	2.16	2.12	2.11	2.13	2.13	2.14	2.13
16	Industrial Engineering(120501)	2.23	2.23	2.21	2.24	2.24	2.24	2.28	2.23	2.24	2.26	2.24	2.23	2.23	2.24
17	Metal cutting and machine tools (120502)	2.40	2.41	2.52	2.47	2.33	2.49	2.41	2.52	2.21	2.23		2.45	2.39	2.42
18	Heat & Mass Transfer(120503)	2.02	2.03	2.00	2.03	1.96	2.03	2.03	2.03	2.01	1.97	2.05	2.03	2.03	2.01
19	Thermal Engineering (120504)	2.18	2.23	2.05	2.13	2.14	2.20	2.18	2.14	2.16	2.19	2.20	2.18	2.19	2.16
20	Machine Design(120505)	2.16	2.18	2.18	2.18	2.08	2.21	2.11	2.23	2.22	2.19		2.16	2.11	2.18
21	Heat & Mass Transfer lab (120503 P)	2.22	2.20	2.24	2.23	2.19	2.22	2.22	2.22	2.13	2.20	2.27	2.22	2.20	2.28
22	Thermal Engineering lab (120504 P)	2.32	2.32	2.34	2.37	2.32	2.32	2.32	2.29	2.32	2.34	2.23	2.31	2.35	2.32
23	Machine Design lab (120505 P)	2.26	2.27	2.31	2.28	2.22	2.29	2.22	2.31	2.31	2.22		2.26	2.23	2.27
24	Minor Project-I (120506)	2.22	2.20	2.18	2.22	2.16	2.23	2.23	2.23	2.14	2.18	2.23	2.23	2.20	2.26
25	Summer Internship Project-II (120507)	2.16	2.18	2.17	2.14	2.07	2.22	2.04		2.16	2.17	2.19	2.15	2.16	2.16
26	Self-learning/Presentation (120508)	2.27	2.23	2.28	2.31	2.08	2.27	2.41	2.15	2.29	2.39	2.17	2.30	2.33	2.29

27	Ethics, Economics, Entrepreneurship & Management (100005)	2.11	2.11	2.16	2.19	2.07	2.12	2.05	2.22	2.13	2.19	2.12	2.12	2.13	2.09
28	Advance Production Technology (120601)	2.30	2.20	2.28	2.26	2.43	2.35	2.21	2.37	2.08	2.30	2.17	2.28	2.29	2.30
29	Vibration & Noise Engineering (120611)	2.09	2.07	2.08	2.07	2.04	2.07	2.07		2.08	2.10	2.13	2.07	2.10	2.10
30	Statistical & Quality Control (120612)	2.09	2.10	2.09	2.09	2.01	2.12	2.01		2.09	2.09	2.04	2.08	2.09	2.08
31	Work Study & Ergonomics (120613)	2.23	2.20	2.26	2.22	2.13	2.32	2.22	2.13	2.24	2.19	2.17	2.26	2.24	2.27
32	Turbo Machinery (120614)	2.21	2.29	2.23	2.22	2.29		2.20	2.29	2.43	2.27	2.24		2.22	2.27
33	Advance Production Technology lab (120601 P)	2.24	2.18	2.18	2.26	2.24	2.36	2.16	1.90	2.24	2.15	2.04	2.25	2.22	2.27
34	Disaster Management (100007)	2.22	2.25	2.24	2.18	2.15	2.32	2.05		2.22	2.23	2.35	2.21	2.22	2.22
35	Minor Project-II (120605)	2.14	2.14	2.16	2.14	2.15	2.21	2.22	2.10	2.13	1.93	2.12	2.13	2.10	2.15
36	Refrigeration and Air-Conditioning (120711)	2.36	2.30	2.26	2.07	2.46	2.54	2.40	2.53	2.37	2.46	2.46		2.28	2.28
37	Metrology, Measurement and Control (120713)	2.21	2.23	2.22	2.25	2.17	2.21	2.19	2.19	2.25	2.23	2.20	2.20	2.19	2.22
38	TQM (120714)	2.43	2.37	2.35	2.37	2.31	2.38	2.39	2.37	2.37	2.39	2.46	2.35	2.35	2.37
39	Intellectual Property Rights (100008)	2.50	2.50	2.54	2.48	2.47	2.51	2.47	2.50	2.48	2.49	2.48	2.54	2.52	2.47
40	Reliability and Vibration Lab (120705)	2.17	2.17	2.17	2.16	2.14	2.16	2.18	2.16	2.18	2.15		2.15		
41	Summer Internship Project - III (120706)	2.60	2.59	2.60	2.59	2.60	2.58	2.58	2.51	2.60	2.68	2.62		2.63	
42	Creative Problem Solving (120707)	2.72	2.73	2.72	2.72	2.70	2.68	2.73	2.72	2.70	2.68	2.75	2.72	2.68	2.67
43	Industrial Automation (900203)	2.65	2.65	2.65	2.65	2.64	2.64	2.64	2.66	2.64	2.65	2.65	2.64	2.64	2.65
44	Solar Energy (900204)	2.70	2.68	2.69	2.70	2.66	2.70	2.67	2.68	2.69	2.69	2.69	2.69	2.70	2.70
45	Engineering Materials for Industrial Applications (900214)	2.59	2.58	2.59	2.58	2.58	2.59	2.56	2.57	2.62	2.59	2.58	2.59	2.57	2.55
46	Maintenance Engineering (900215)	2.68	2.68	2.68	2.67	2.69	2.69	2.68	2.67	2.70	2.69	2.69	2.69	2.68	2.67
47	Quality Design and Control (120851)	2.32	2.35	2.35	2.41	2.25	2.18	2.29	2.19	2.35	2.17	2.18	2.26	2.18	2.28
48	Robotics: Basics and Selected Advanced Concepts (120852)	2.20	2.23	2.21	2.35	2.22	2.21	2.23	2.18	2.18	2.25	2.26	2.20	2.22	
49	Carbon materials and manufacturing (120855)	2.38	2.27	2.16	2.28	2.29	2.04	2.05	2.39	2.18	2.29	2.26	2.28	2.38	2.38
50	Internship/Project (120801)	2.22	2.18	2.20	2.14	2.22	2.28	2.23	2.21	2.22	2.16	2.23	2.28	2.22	2.13
51	Professional Development (120802)	2.34	2.39	2.26	2.26	2.17	2.21	2.32	2.36	2.17	2.29	2.17	2.17	2.21	2.28

INDIRECT PO ATTAINMENT		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
Exit Survey		2.04	2.13	2.09	2.16	2.05	2.13	2.03	2.19	2.09	2.13	2.16	2.12	2.18	2.11
Alumni Survey		2.19	2.07	2.06	1.99	1.96	2.08	1.97	1.99	2.03	2.01	1.96	2.14	2.07	1.91
Employer Survey		1.84	1.93	1.90	1.74	1.61	1.66	1.87	1.83	1.82	1.90	1.88	1.81	1.86	1.58
Indirect PO Attainment		2.02	2.04	2.02	1.97	1.87	1.96	1.96	2.02	1.98	2.01	1.94	1.86	1.97	1.37





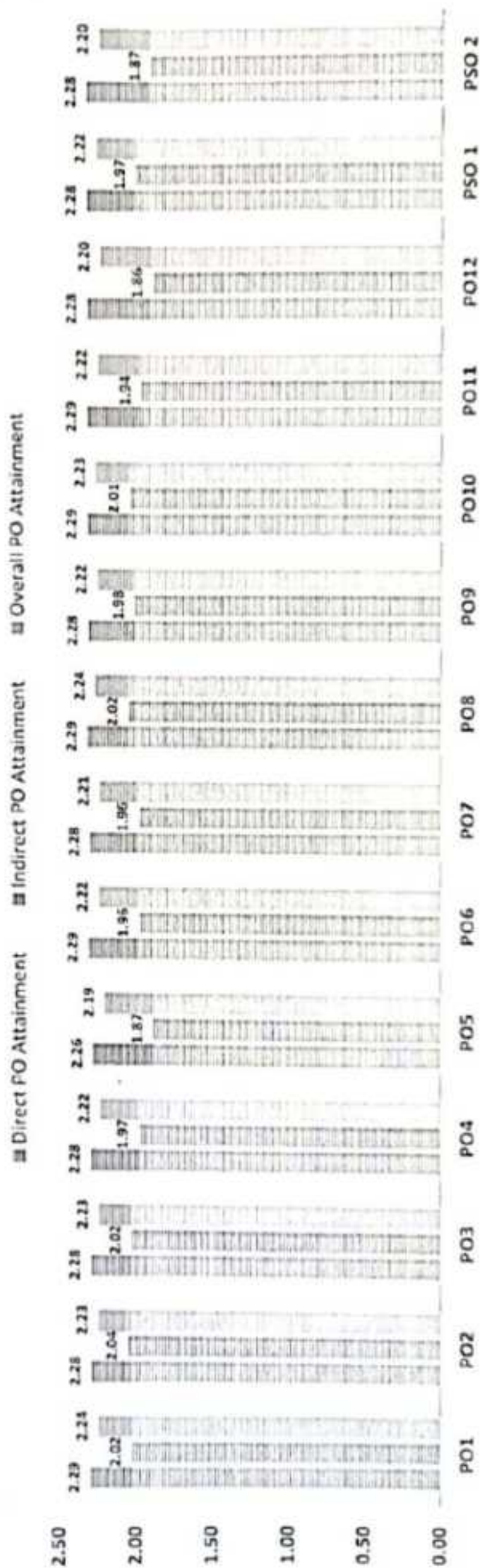


Madhav Institute of Tecnology & Science Gwalior-5

Department : Mechanical Engineering	Year 2019-2023
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PO ATTAINMENT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
Direct PO Attainment	2.29	2.28	2.28	2.28	2.26	2.29	2.28	2.29	2.28	2.29	2.29	2.28	2.28	2.28
Indirect PO Attainment	2.02	2.04	2.02	1.97	1.87	1.95	1.96	2.02	1.98	2.01	1.94	1.86	1.97	1.87
Overall PO Attainment	2.24	2.23	2.23	2.22	2.19	2.22	2.21	2.24	2.22	2.23	2.22	2.20	2.22	2.20

PO ATTAINMENT MECHANICAL 2019-2023 BATCH










Item ME21	To review and finalize the CO-PO mapping matrix for all the courses to be taught in July-Dec 2024.
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A row of six handwritten signatures in blue ink, positioned below the table row. The signatures are stylized and vary in length and complexity.

Department of Mechanical Engineering

Subject	Code	Course Outcomes	PO1 (Engineering Knowledge)	PO2 (Problem Analysis)	PO3 (Design & Development of Solutions)	PO4 (Conduct investigation of complex Problems)	PO5 (Modern tools & techniques)	PO6 (The Engineer and society)	PO7 (Environment and sustainability)	PO8 (Ethics)	PO9 (Individual and team work)	PO10 (Communication)	PO11 (Project Management & Financing)	PO12 (Life-long Learning)	PSO1	PSO2
Petroleum Measurement and Control	120732	CO1	3	1	1	1	3	1	1	1	1	1	1	3	1	1
		CO2	3	1	1	2	3	1	1	1	1	2	1	3	1	1
		CO3	3	2	2	2	3	2	2	1	1	1	1	3	2	2
		CO4	3	3	3	3	3	2	2	1	1	1	1	3	2	1
		CO5	3	3	3	3	3	2	1	2	2	1	2	3	2	2
		CO6	3	3	3	3	3	2	2	1	1	2	2	3	2	2
Total Quality Management	120733	CO1	3	1	1	1	3	1	1	1	1	1	1	3	1	1
		CO2	3	1	1	2	3	1	1	1	1	2	2	3	1	1
		CO3	3	1	2	2	3	2	2	1	1	1	2	3	2	1
		CO4	3	2	3	3	3	2	2	1	2	1	3	3	1	1
		CO5	3	2	3	3	3	2	1	2	2	2	3	3	1	1
		CO6	3	2	3	2	3	2	2	1	2	2	3	3	2	1
Turbo Machinery	120734	CO1	3	3	3	3	2	1	1	1	1	1	1	3	2	1
		CO2	3	3	3	3	2	1	1	1	1	1	1	3	1	1
		CO3	3	3	3	3	2	2	1	1	1	2	1	3	2	1
		CO4	3	3	3	3	3	1	2	1	1	1	1	3	1	1
		CO5	3	3	3	3	3	2	1	2	2	1	2	3	1	1
		CO6	3	3	3	3	2	1	1	1	1	2	2	3	2	2
Vehicle Dynamics	190731	CO1	3	1	1	1	3	1	1	1	1	1	1	3	1	1
		CO2	3	1	1	1	3	1	1	1	1	2	1	3	1	1
		CO3	3	3	1	1	3	2	1	1	2	2	1	3	1	1
		CO4	3	3	2	1	3	1	2	1	1	2	1	3	1	1
		CO5	3	3	2	1	3	2	1	2	2	1	2	3	1	2
		CO6	3	3	3	3	3	3	2	1	2	2	2	3	1	2
Hybrid electric Vehicles	190732	CO1	3	1	1	1	3	1	1	1	1	1	1	3	1	1
		CO2	3	1	1	1	3	1	1	2	1	2	1	3	1	1
		CO3	3	2	2	2	3	2	1	2	2	2	1	3	1	1
		CO4	3	3	2	1	3	1	2	2	1	2	1	3	1	1
		CO5	3	3	2	1	3	2	1	2	2	1	2	3	1	2
		CO6	3	3	3	3	3	3	2	1	2	2	2	3	1	2

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Solar energy	910208	CO1	3	1	1	1	1	1	1	1	3	1	1
		CO2	3	1	1	1	1	1	1	1	3	2	2
		CO3	3	3	3	1	1	1	2	1	3	2	2
		CO4	3	3	3	2	1	1	1	1	3	2	2
		CO5	3	3	3	1	2	1	1	2	3	2	2
		CO6	3	3	3	2	1	2	1	1	3	1	1
Maintenance Engineering	910209	CO1	3	1	1	1	1	1	1	1	3	1	1
		CO2	3	2	1	1	1	1	1	1	3	1	1
		CO3	3	3	3	1	1	1	1	1	3	2	1
		CO4	3	3	3	1	1	1	1	1	3	2	1
		CO5	3	3	3	1	1	1	1	1	3	2	1
		CO6	3	3	3	2	1	2	1	1	3	1	1
Advanced Manufacturing Technology	2190512 / 212051 ₂	CO1	3	1	1	1	1	1	2	1	3	1	1
		CO2	3	3	1	1	1	1	1	1	3	1	1
		CO3	3	3	2	1	1	1	1	1	3	1	2
		CO4	3	3	3	2	1	1	1	1	3	1	1
		CO5	3	3	3	2	1	1	1	1	3	2	1
		CO6	3	3	3	3	2	3	1	1	3	2	2
Applied Thermodynamics	2190513 / 212051 ₃	CO1	3	3	3	1	1	1	1	1	3	1	1
		CO2	3	3	3	1	1	1	1	1	3	1	-
		CO3	3	3	3	2	1	1	1	1	3	1	1
		CO4	3	3	3	1	2	1	1	1	3	1	1
		CO5	3	3	3	2	1	2	2	1	3	1	1
		CO6	3	3	3	3	2	3	1	1	3	2	1
Heat and Mass Transfer	2190514 / 212051 ₄	CO1	3	3	3	1	1	1	1	1	3	2	1
		CO2	3	3	3	1	1	1	1	1	3	1	1
		CO3	3	3	3	2	1	1	1	2	3	2	1
		CO4	3	3	3	1	2	1	1	1	3	1	1
		CO5	3	3	3	2	1	2	2	1	3	1	1
		CO6	3	3	3	3	2	3	1	2	3	2	2
Automotive chassis	2190515	CO1	3	1	1	1	1	1	1	1	3	1	1
		CO2	3	1	1	1	1	1	1	2	3	1	1
		CO3	3	3	1	1	1	1	2	1	3	1	1
		CO4	3	3	2	1	2	1	1	1	3	1	1
		CO5	3	3	2	1	1	2	2	1	3	1	2
		CO6	3	3	3	3	2	3	1	2	3	1	2






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Department of Mechanical Engineering

Department of Mechanical Engineering															
Solar energy	910208	CO1	3	1	1	1	1	1	1	1	1	3	1	1	
		CO2	3	1	1	1	1	1	1	1	1	1	3	2	2
		CO3	3	3	2	1	1	1	1	2	1	1	3	2	2
		CO4	3	3	1	2	1	1	1	1	1	1	3	2	2
		CO5	3	3	2	1	2	1	1	1	2	1	3	1	1
		CO6	3	3	1	1	1	1	1	1	1	1	3	1	1
Maintenance Engineering	910209	CO1	3	1	1	1	1	1	1	1	1	3	1	1	
		CO2	3	2	1	1	1	1	1	1	1	1	3	2	1
		CO3	3	3	2	1	1	1	1	1	1	1	3	2	1
		CO4	3	3	1	1	1	1	1	1	1	1	3	2	1
		CO5	3	3	1	1	1	1	1	1	1	1	3	1	1
		CO6	3	3	1	1	1	1	1	1	1	1	3	1	1
Advanced Manufacturing Technology	2190512/2120512	CO1	3	1	1	1	1	1	1	2	1	3	1	1	
		CO2	3	3	1	1	1	1	1	1	1	1	3	1	2
		CO3	3	3	2	1	1	1	1	1	1	1	3	1	1
		CO4	3	3	1	2	1	1	1	1	1	1	3	1	1
		CO5	3	3	2	1	1	1	1	1	1	1	3	2	2
		CO6	3	3	3	2	3	1	1	1	1	1	3	1	1
Applied Thermodynamics	2190513/2120513	CO1	3	3	3	1	1	1	1	1	1	3	1	-	
		CO2	3	3	3	1	1	1	1	1	1	1	3	1	1
		CO3	3	3	3	2	1	1	1	1	1	1	3	1	1
		CO4	3	3	3	1	2	1	1	1	1	1	3	1	1
		CO5	3	3	3	2	1	2	1	1	1	2	3	1	1
		CO6	3	3	3	2	3	1	1	1	1	1	3	2	1
Heat and Mass Transfer	2190514/2120514	CO1	3	3	3	1	1	1	1	1	1	3	2	1	
		CO2	3	3	3	1	1	1	1	1	1	1	3	1	1
		CO3	3	3	3	2	1	1	1	2	1	1	3	2	1
		CO4	3	3	3	1	2	1	1	1	1	1	3	1	1
		CO5	3	3	3	2	1	2	1	1	1	2	3	1	1
		CO6	3	3	3	1	1	1	1	1	2	1	3	1	1
Automotive chassis	2190515	CO1	3	1	1	1	1	1	1	1	1	3	1	1	
		CO2	3	1	1	1	1	1	1	2	2	1	3	1	1
		CO3	3	3	1	1	1	1	2	2	2	1	3	1	1
		CO4	3	3	2	1	1	1	2	2	2	1	3	1	1
		CO5	3	3	2	1	2	2	1	1	2	2	3	1	2
		CO6	3	3	3	2	3	1	2	2	2	2	3	1	2

Department of Psychology

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Department of Mechanical Engineering

CO4	3	3	2	3	3	1	1	2	1	2	1	3	1	1
CO5	3	3	3	3	3	3	1	2	1	2	1	3	2	3
CO6	3	3	3	3	3	3	2	2	1	2	1	3	2	3









Item ME22	To review curricula feedback from various stakeholders, its analysis and impact
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8 N B K R



MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.)
(A Deemed to be University)
Department of Mechanical Engineering

Student's Feedback on Curriculum
Action Taken on Student's Feedback

S. No.	Subject	Feedback	Action Taken
1	Materials Science	Nano Technology related syllabus should be introduced	Unit 5 of the syllabus includes the nano and smart materials
2	Manufacturing Processes	Advanced Manufacturing techniques should be introduced	The subject Advanced manufacturing techniques includes the particular part of advancement in technology
3	Refrigeration and air conditioning	Industry oriented contents should be added.	In general syllabus of the subject is industry oriented but industry oriented problems will be added in the tutorial section.

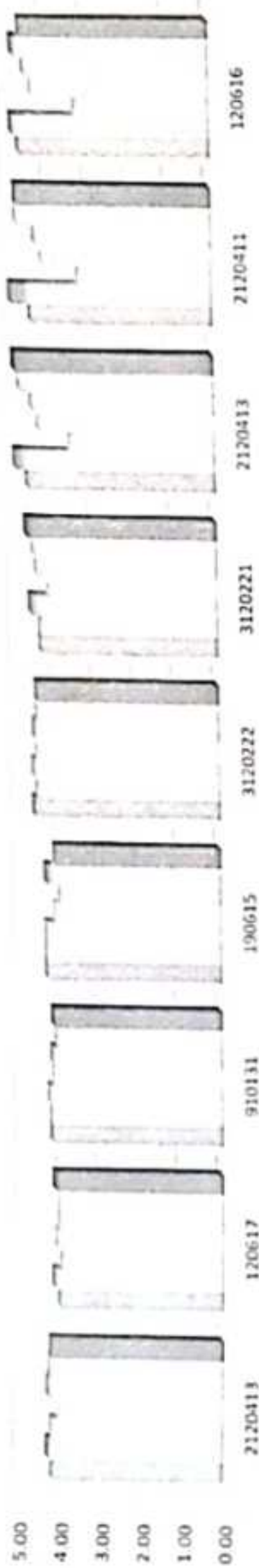






MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.)
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Department of Mechanical Engineering

Students feedback on course content_Curriculum



- The course is well designed
- The syllabus units are balanced
- The learning material was available to you
- The content was clear and easy to understand
- The course was relevant and updated for present needs
- The course meets your career expectations
- The course will be useful to meet your higher studies/future aspirations.

Subject Code	2120413	120617	910131	190615	3120222	3120221	2120413	2120411	120616
The course is well designed	4.18	4.06	4.24	4.33	4.59	4.38	4.63	4.47	4.68
The syllabus units are balanced	4.30	4.19	4.24	4.33	4.51	4.38	4.92	4.96	4.84
The learning material was available to you	4.21	4.00	4.30	4.33	4.59	4.61	3.57	3.29	3.29
The content was clear and easy to understand	4.06	4.13	4.19	4.11	4.51	4.15	4.35	4.20	4.35

3 2 P W e R D



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The course was relevant and updated for present needs	4.33	4.06	4.22	4.00	4.57	4.46	4.51	4.36	4.53
The course meets your career expectations	4.30	4.06	4.11	4.33	4.51	4.53	4.8	4.8	4.8
The course will be useful to meet your higher studies/future aspirations.	4.27	4.19	4.19	4.11	4.51	4.69	4.92	4.8	4.6

Dr. M. V. R. S. R.



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Department of Mechanical Engineering

Teacher's Feedback on Curriculum

Action Taken on Teacher's Feedback

S.No.	Subject	Feedback	Action Taken
1	APT	Automation in Manufacturing should be the part of syllabus	Subject advanced manufacturing technology has will be discussed in BoS
2	Mechatronics	Machinery Fault Diagnosis and Signal Processing	It is Advanced courses which is running through NPTEL and will be discuss in the upcoming BoS
3	Industry 4.0	Metal Additive Manufacturing, Rapid Manufacturing, Laser Based Manufacturing	This implementation will be done in upcoming BoS meeting, as this course will be offered to the students through NPTEL and NEC courses

Overall Rating

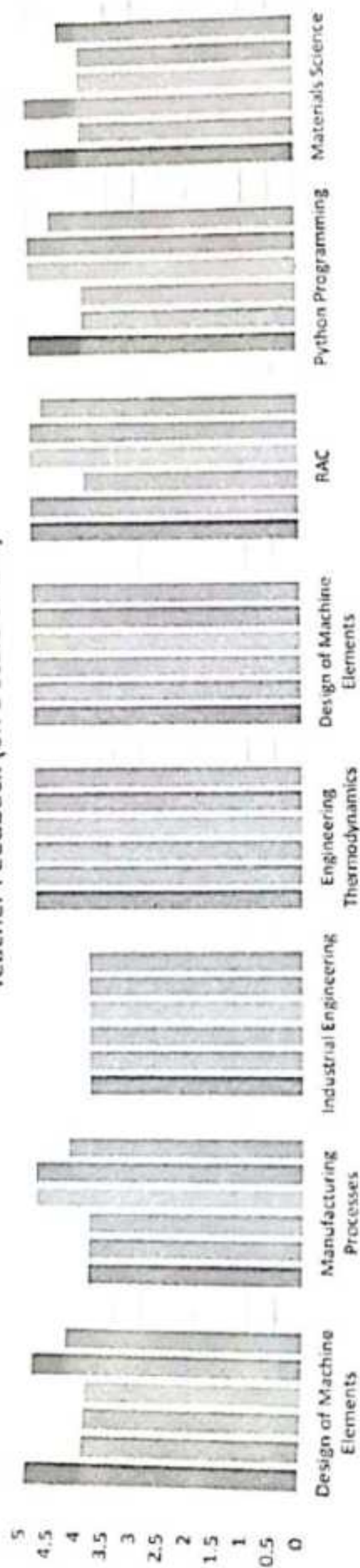
5									
4									
3									
2									
1									
0									
	Design of Machine Elements	Manufacturing Processes	Industrial Engineering	Engineering Thermodynamics	Design of Machine Elements	RAC	Python Programming	Materials Science	

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Department of Mechanical Engineering

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.
- Overall Rating

Dr. R. K. Singh



MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.)
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Department of Mechanical Engineering

Course 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
Design of Machine Elements	5	4	4	4	5	4.4
Manufacturing Processes	4	4	4	5	5	4.4
Industrial Engineering	4	4	4	4	4	4
Engineering Thermodynamics	5	5	5	5	5	5
Design of Machine Elements	5	5	5	5	5	5
RAC	5	5	4	5	5	4.8
Python Programming	5	4	4	5	5	4.6
Materials Science	5	4	5	4	4	4.4

S R Z F a k A Q



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Department of Mechanical Engineering

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	Industrial need should be fulfilled by employing subject related to industries	Internship in industry is offered in Mechanical VIII semester
2	MATLAB, Ansys, and simulation tool required	Curriculum updated, DE and OCs subjects are available for such courses.
3	ML should be the part of curriculum.	Data science and ML subject has been implemented
4	Students must be more flexible in co-curricular activities along with curriculum	New clubs has been started in different domain of interest to develop students personalities..
5	Practical exposure is very less. Collage not provide any campus recruitment or internship opportunity.	6 month Internship opportunity is providing in VIII sem .

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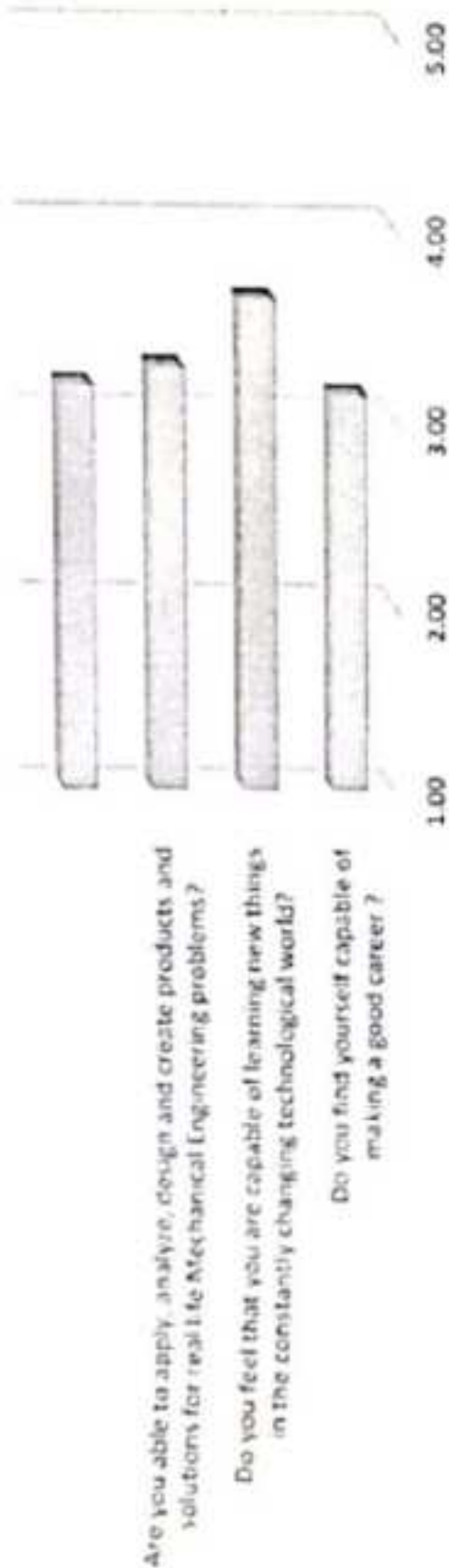


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Average Feedback out of 5



Do you find yourself capable of making a good career?	3.13
Do you feel that you are capable of learning new things in the constantly changing technological world?	3.47
Are you able to apply, analyze, design and create products and solutions for real life Mechanical Engineering problems?	3.03
Do you feel that you are able to manage projects in an ethical manner and work efficiently as a member/leader of multidisciplinary teams?	3.03

Signature of the student



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Employer Feedback

Employer Feedback

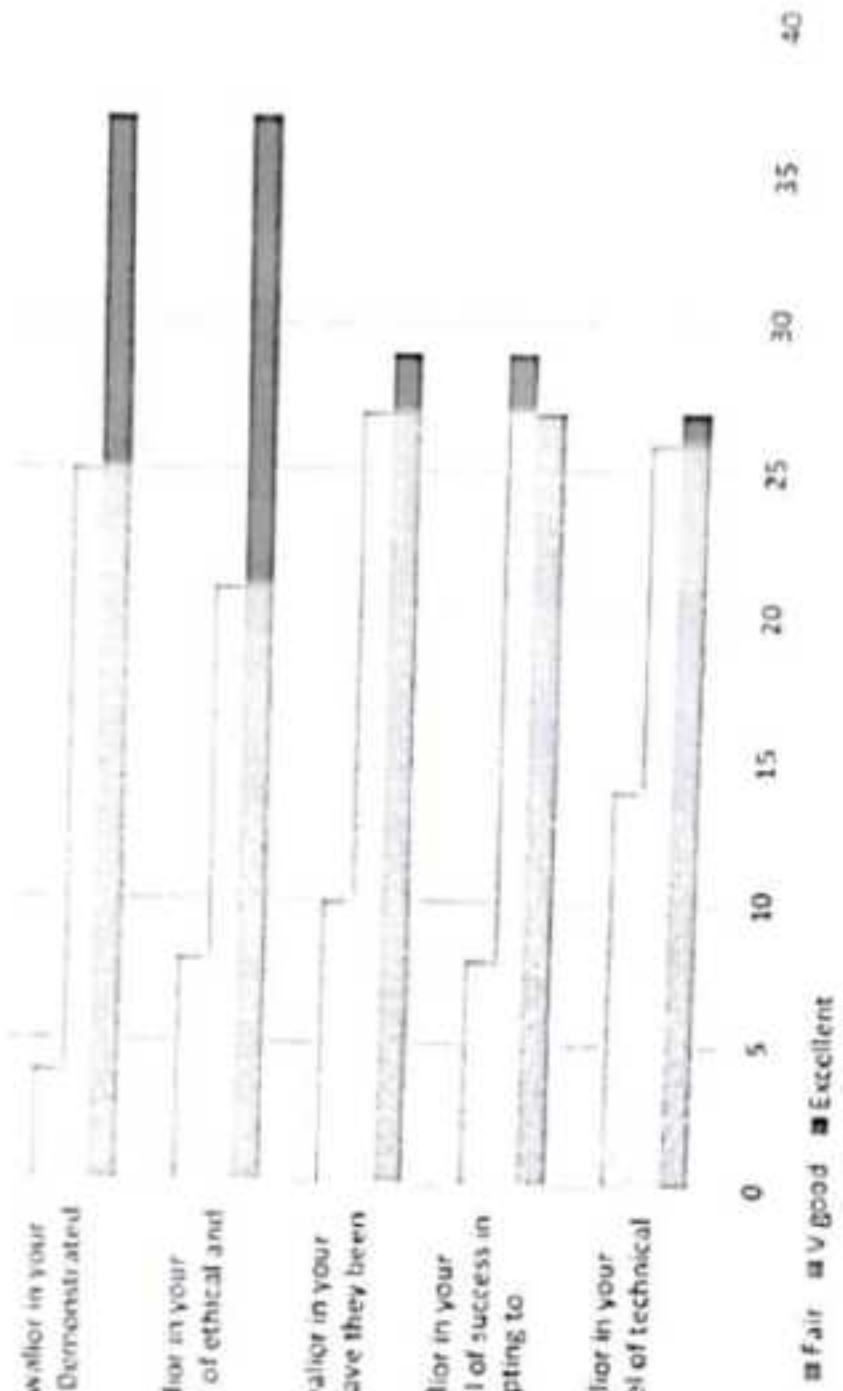
Please characterize the accomplishments of graduates from MITS Gwalior in your company, focusing on their few years performance after graduation [Demonstrated ability to work well in a team]

Please characterize the accomplishments of graduates from MITS Gwalior in your company, focusing on their few years performance after graduation [Level of ethical and social responsibility]

Please characterize the accomplishments of graduates from MITS Gwalior in your company, focusing on their few years performance after graduation [Have they been deserved for elevation to higher level ?]

Please characterize the accomplishments of graduates from MITS Gwalior in your company, focusing on their few years performance after graduation [Level of success in learning new areas, engaging in professional development, and adapting to technological c

Please characterize the accomplishments of graduates from MITS Gwalior in your company, focusing on their few years performance after graduation [Level of technical contribution]



0 5 10 15 20 25 30 35 40
Fair V Good Excellent

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