Dated 332
07/03/2024

MEH-25
28/02/2024

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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

NAAC Accredited with A++ Grade

BOARD OF STUDIES (BoS) PROCEEDING

DEPARTMENT OF MECHANICAL ENGINEERING

(MEETING DATED 1st Dec. 2023)

CONTENTS

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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MINUTES OF MEETING OF BOARD OF STUDIES (BoS)

An online meeting of following members (external and internal) was held on 1st Dec., 2023 at 11:00 AM through online mode (Google Meet Link **meet.google.com/qcw-zqip-txr**).

Following members were present:

(1)	Dr. M.K. Gaur	Head of the Department and Chairman of the Committee
(2)	Dr. Prashant Kumar Jain	Professor, IIITDM, Jabalpur, RGPV Nominee
(3)	Dr. A. K. Tiwari	Professor, NIT, Raipur, AC Nominee
(4)	Er. Anil Gupta	CEO, APN Technologies, New Delhi, Industry Expert
(5)	Er. Amit Lahariya	CPS Leader, Cummins India Pvt. Ltd., Alumni
(6)	Dr. Pratesh Jayaswal	Member
(7)	Dr. Manish Ku. Sagar	Member
(8)	Dr. C. S. Malvi	Member
(9)	Mr. R. P. Kori	Member
(10)	Mr. Vedansh Chaturvedi	Member
(11)	Dr. Jyoti Vimal	Member
(12)	Mr. Sharad Agrawal	Member
(13)	Mr. Vaibhav Shivhare	Member
(14)	Dr. Amit Aherwar	Member
(15)	Mr. Bhupendra K Pandey	Member
(16)	Dr. Nitin Upadhyay	Member
(17)	Dr. Surendra Ku. Chourasiya	Member
(18)	Dr. Gavendra Norkey	Member
(19)	Vansh Vandhe	Student Member, II Year
(20)	Deepak Singh	Student Member, III year
(21)	Anshita Verma	Student Member, III Year
(22)	Piyush Soni	Student Member, IV Year
(23)	Alok Sharma	Student Member, IV Year

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]

1. 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
Quality Design and Control	120861	New tools for managing quality, Design aspects and various parameters	4	16	[illegible]
Robotics: Basics and Selected Advanced Concepts	120862	Industrial application of robots and working codes uses in programming	4	17	
Fundamentals of Theoretical and Experimental Aerodynamics	190861	Analyse the aerodynamic behaviour of component helps in designing the new products	4	13	
Experimental Stress Analysis	190862	Study stress behaviour of different component. It helps in designing the component	4	15	

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
Concepts of Mechanical Systems	910129	To make familiar with the mechanical systems	9	41	https://drive.google.com/[illegible] usp=drive_link
Digital Manufacturing	910130	To introduce advanced techniques of manufacturing and automation	9	43	
Process Planning and Cost Estimation	910131	To prepare planning for production by different machining and estimation of associated cost of the product	9	45	

Feedback on curriculum received from stakeholders: Analysis& ATR*

Stakeholder	Student	Faculty	Alumni	Employer
No. of responses	198	8	90	68
Link of Analysis	https://docs.google.com/spreadsheets/d/[illegible]/edit?usp=drive_link&ouid=[illegible]&rtpof=true&sd=true	https://docs.google.com/spreadsheets/d/[illegible]/edit?usp=drive_link&ouid=[illegible]&rtpof=true&sd=true	https://docs.google.com/spreadsheets/d/[illegible]/edit?usp=sharing&ouid=[illegible]&rtpof=true&sd=true	https://docs.google.com/spreadsheets/d/[illegible]/edit?usp=drive_link&ouid=[illegible]&rtpof=true&sd=true
ATR Link	https://drive.google.com/file/d/[illegible]/view?usp=drive_link	https://drive.google.com/file/d/[illegible]/view?usp=drive_link	https://drive.google.com/file/d/[illegible]/view?usp=drive_link	https://drive.google.com/file/d/[illegible]/view?usp=drive_link
Link showing Excel sheet of Google Form details of stakeholders	https://docs.google.com/spreadsheets/d/[illegible]/edit?usp=drive_link&ouid=[illegible]&rtpof=true&sd=true	https://docs.google.com/spreadsheets/d/[illegible]/edit?usp=drive_link&ouid=[illegible]&rtpof=true&sd=true	https://docs.google.com/spreadsheets/d/[illegible]/edit?usp=sharing&ouid=[illegible]&rtpof=true&sd=true	https://docs.google.com/spreadsheets/d/[illegible]/edit?usp=drive_link&ouid=[illegible]&rtpof=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**

2. 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.**

3. 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 on each feedback
   - Google form showing responses from alumni, employer, student, faculty etc

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

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

BoS Agenda Items

Item ME1

To confirm the minutes of previous BoS meeting held in the month of May-June 2023.

The minutes of the last BoS held on 2nd June 2023 were confirmed. The BoS Minutes were presented & approved in Academic Council Meeting held on 30th June 2023.

Item ME2

The examination committees constituted vide Dean Academics Notice no 1332 dated 20/4/2021 need to be reconstituted this year.

1. Dr. M. K. Gaur
2. Dr. C.S. Malvi
3. Dr. M. K. Sagar
4. Dr. Jyoti Vimal
5. Dr. Sanjay Tiwari (Director Nominee)

Item ME3

To propose the scheme structure of **VIII Semester** with the provision of **ONE DE & ONE OC course** to be offered in **online mode** with credit transfer for the batch admitted in academic year 2020-21. **(The total credits from I-VIII semester should not be less than 160 for this batch)**.

S.No.	Subject Code	Category	Subject Name
1.	DE*	DE	Departmental Elective (DE-5)
2.	OC*	OC	Open Category (OC-3)
3.	120811/190811	DLC	Internship/Research Project/ Innovation & Start-up
4	120812/190812	PD	Professional Development

Item ME4

To propose the list of courses which the students can opt from SWAYAM/NPTEL/ other MOOC Platforms/ Institution (MITS) MOOC, to be offered in online mode under **Departmental Elective (DE) category courses (DE-5) and open category (OC3)** for credit transfer in the **VIII Semester** under the flexible curriculum (Batch admitted in academic year 2020-21)

Departmental Elective (DE) category courses (DE-5)					Open Category (OC3)	
Mechanical Engineering			Automobile Engineering		Mechanical Engg. Dept.	
S.No.	Subject Code	Subject Name	Subject Code	Subject Name	Subject Code	Subject Name
1	120861	Quality Design and Control	190861	Fundamentals of Theoretical and Experimental Aerodynamics		Theory and Practice of Non-Destructive Testing
2	120862	Robotics: Basics and Selected Advanced Concepts	190862	Experimental Stress Analysis		Product Design and Manufacturing
3	120863	Carbon Materials and Manufacturing				Automatic Control
						Introduction to Solidification Processing

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Item ME5

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. VIII semester students (for the batch admitted in 2020-21)] and for B.Tech. VI semester (for the batch admitted in 2021-22)]

Honor's	Minor Specialization	Minor Specialization
VIII (for the batch Admitted in 2020-21)	**VIII (for the Batch admitted in 2020-21)**	**VI (for the Batch admitted in 2020-21)**
Computer integrated Manufacturing (12 Weeks)	Computational Fluid Dynamics for Incompressible Flows (12 weeks)	Fundamental of Combustion (12weeks)
Solar Photovoltaic: Principles, Technologies & Materials (8 weeks)	Mechanics of Machining (8 weeks)	Introduction to Mechanical Micro Machining (12 weeks)
Oil Hydraulics and Pneumatics (12 weeks)		

2021 admitted batch Tracks (Jan-June 2023)

Sr No.	Design Track	Thermal Track	Production Track
	Honors (Jan.-June)	Honors (Jan.-June)	Honors (Jan.-June)
1	Design, Technology and Innovation(8 week)	Computational Fluid Dynamics for Incompressible Flows(12 Weeks)	Introduction To Mechanical Micro Machining(8 weeks)
2	Experimental Stress Analysis(12 weeks)	Turbulent Combustion: Theory And Modelling (12 weeks)	Product Design and Manufacturing (12 weeks)
3	Robotics: Basics and Selected Advanced Concepts(8 weeks)	Experimental Methods in Fluid Mechanics(12 Weeks)	Mechanics of Fiber Reinforced Polymer Composite Structures(12 weeks)
4	Modeling and Simulation of Dynamic Systems(8 Weeks)	Heat Transfer and Combustion in Multiphase Systems (8 Weeks)	Fundamentals of Electronic Materials And Devices (8 weeks)

Item ME6

To review and finalize the **scheme structure of B.Tech VI Semester under** the flexible curriculum **(Batch admitted in 2021-22)**

Mechanical Engineering				Automobile Engineering		
S.No.	Subject Code	Category	Subject Name	Subject Code	Category	Subject Name
1.	120615	DC	Mechanical Vibrations (DC-13)	190615	DC	Automotive Transmission (DC-13)
2.	120616	DC	Refrigeration and Air-Conditioning (DC-14)	190616	DC	Refrigeration and Air-Conditioning (DC-14)
3.	DE	DE	Departmental Elective* (DE-1)	DE	DE	Departmental Elective* (DE-1)
4.	OC	OC	Open Category (OC-1)**	OC	OC	Open Category (OC-1)**
5.	120617	MC	Artificial Intelligence & Machine Learning	190617	MC	Artificial Intelligence & Machine Learning
6.	120618	DLC	Minor Project-II	190618	DLC	Minor Project-II
7.	200XXX	CLC	Novel Engaging Course (Informal Learning)	200XXX	CLC	Novel Engaging Course (Informal Learning)
8.	1000007	MAC	Intellectual Property Rights (IPR)	1000007	MAC	Intellectual Property Rights (IPR)

Dept. of Mechanical Engineering BoS 01/12/2023

Item ME7

To review & finalize the syllabi for all Departmental Core Courses (DC) and Mandatory Course (MC) of B Tech VI Semester (for batch admitted in 2021-22) under the flexible curriculum along with their COs.

S.No.	Mechanical Engineering			Automobile Engineering		
	Subject Code	Category	Subject Name & Title	Subject Code	Category	Subject Name
1.	120615	DC	Mechanical Vibrations	190615	DC	Automotive Transmission
2.	120616	Dc	Refrigeration and Air-conditioning	190616	DC	Refrigeration and Air-conditioning

Item ME8

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered (for batches admitted in 2021-22) **in online mode under Departmental Elective (DE-1) Course** with credit transfer, in the VI Semester.

S.No.	Automobile Engineering			Mechanical Engineering		
	Subject Code	Category	Subject Name & Title	Subject Code	Category	Subject Name
1.	190661	DE	Fundamentals of Automotive Systems	120661	DE	Fundamental of Welding Science and Technology
2.	190662	DE	Viscous Fluid Flow	120662	DE	Viscous Fluid Flow
3.				120663	DE	Properties of Materials (Nature and Properties of Material: III)

Item ME9

To review and finalize the courses & syllabi to be offered (for batch admitted in 2021-22) under the Open Category (OC) Courses (in traditional mode) for VI semester students of other departments along with their COs.

Open Category (OC1)	
Mechanical Engg. Dept.	
Subject Code	Subject Name
910129	Concepts of Mechanical Systems
910130	Digital Manufacturing
910131	Process Planning and Cost Estimation

Item ME10

To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B.Tech.VI semester **(for batch admitted in 2021-22).**

Mechanical/Automobile Engg. VI Sem		
S.No.	Subject Code	Subject Name
1	120616/190616	Refrigeration and Air-conditioning
2	190615	Automotive Transmission
3	120615	Mechanical Vibrations

Item ME11

To review and finalize the suggestive list of projects which can be offered under the '**Skill based mini-project**' category in various laboratory components based courses to be offered in B Tech VI Semester **(for the batch admitted in 2021-22)**.

120616/190616: Refrigeration and Air-conditioning	**190615: Automotive Transmission**	**120615: Mechanical Vibrations**
1. Solar milk warmer cum cooler by vapour compression cycle refrigeration system. 2.Air purification using Electrostatic plate and coupled with Dehumidifier. 3.Air conditioning system by vehicle suspensor. 4. Heat dissipation in cars using thermo electric Refrigeration. 5. Solar Peltier Air Conditioner / Refrigerater. 6.Solar powered Electrolux Refrigeration System. 7.Water cooler cum Water Heater by using Refrigeration System. 8. Electrical Power Generation and Refrigeration by using waste heat from IC Engine. 9. Bicycle powered Refrigerator. 10. Air preheating System using condenser waste heat in Automobile.	1. Sterling Engine Helicopter. 2. FE-bow mechanism – Gearless Transmission System. 3. Miniature Shiftless Transmission. 4. Wireless Power Transmission via Solar Power Satellite. 5. Fabrication of Solar railway track crack detecting vehicle. 6. Fabrication of Automatic Vehicle Over speed controlling system for School Zone. 7.Over speed indication and Automatic accident Avoiding System for four-wheeler. 8. Button operated electro- magnetic gear shifting system for two-wheeler. 9. Highways High Speed Sensing and Automatic Speed Braking System. 10. Automatic temperature controller with cooling system for car.	1. Pass-by Noise Reduction in Motorcycles by designing a Hybrid Muffler. 2. Shock Absorber Design for Rickshaw. 3. Mode Shapes of Cantilever beam. 4. Mode Shapes of Aeroplane Model. 5. Modal analysis of a L-Shaped Structure. 6. Vibration Analysis of Multi-storey Building. 7. Model Frequencies of Steering Wheel. 8. Design and construction of a spring loaded mass launcher. 9. Design of a Vibration Isolation System. 10. Design and construction of a small solar-powered vehicle.

Item ME12

To review and finalize the scheme and syllabi of B. Tech. IV Semester **(for batch admitted in 2022-23)** under the flexible curriculum along with their COs.

	Mechanical Engineering			**Automobile Engineering**		
S.No.	**Subject Code**	**Category**	**Subject Name**	**Subject Code**	**Category**	**Subject Name**
1.	2100028	DC	Engineering Mathematics- III	2100028	DC	Engineering Mathematics-III
2	2120411	DC	Industrial Engineering	2190411	DC	Industrial Engineering
3.	2120412	DC	Design of Machine Elements	2190412	DC	Design of Machine Elements
4	2120413	DC	Theory of Machines – II	2190413	DC	Theory of Machines - I
5	2120414	MC	Cyber Security	2190414	MC	Cyber Security
6	2120415	DLC	Production Lab	2190415	DLC	Production Lab
7.	200xxx	CLC	Novel Engaging Course	200xxx	CLC	Novel Engaging Course (Informal Learning)
8.	3000002	Natural Sciences	Engineering Chemistry	3000002	Natural Sciences	Engineering Chemistry
9	1000001	MAC	Indian Constitution and Traditional Knowledge	1000001	MAC	Indian Constitution and Traditional Knowledge

Item ME13

To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in Batch IV semester **(for batch admitted in 2022-23)**.

2120412/2190412: Design of Machine Elements	**2120415/2190415: Production Lab**	**2120413/2190413: Theory of Machine I/II**
1. Design and drawing of Single, double and triple riveted joint 2. Design and drawing of Single and double strap butt joint 3. Design and drawing of Welded joint 4. Design and drawing of Socket and	1. Step Turning and Taper Turning on Lathe 2. Threads Cutting and Knurling on Lathe 3. Machining Flat Surface using Shaper Machine.	1. Study of various types of gears. 2. Study of various types of gear trains. 3. Balancing of rotating masses. 4. Balancing of reciprocating masses. 5. Study of kinematic synthesis of mechanisms. 6. Study of cams and followers.

	Spigot cotter joint 5. Design and drawing of Gib and Cotter joint 6. Design and drawing of Knuckle joint 7. Study of Theories of failure 8. Design and drawing of Solid and hollow shaft 9. Design and drawing of Rigid coupling 10. Design and drawing of Flexible coupling	4. Manufacturing of Spur Gear using Milling Machine 5. Making Internal Splines using Slotting Machine. 6. Hole on work piece through Drilling. 7. Grinding of Single Point Cutting Tool	7. To draw cam profile, velocity and acceleration diagrams of a given cam-follower mechanism 8. Draw the profile of various cams with different types of followers 9. Plot the follower displacement vs angle of cam rotation curves for changing compression spring, follower weights and cam speed 10. Calculate the epicyclic gear ratio, input torque, holding torque and output torque.

Item ME14

To review and finalize the suggestive list of projects which can be offered under the '**Skill based mini-project**' category in various laboratory components based courses to be offered in B. Tech IV Semester ***(for the batch admitted in 2022-23)***.

2120412/2190412: Design of Machine Elements	**2120415/2190415: Production Lab**	**2120413/2190413: Theory of Machine I/II**
1. FEA of lap joint based on various geometrical parameters to study the behaviour of weld strength 2. Simulation of welding to study residual stress and distortions 3. Analysis of composite multi leaf spring using ANSYS 2020 R1 4. Heat Transfer analysis for different materials of ball bearing using ANSYS 2020 R1 5. Numerical analysis of Modified tooth in Spur Gear for increasing the performance by reducing the assembly errors and gear slippage in the axial direction during dynamic loading.	1. Slot / Groove cutting using shaping machine. 2. Performance on mold making of Simple component. 3. Performance on pattern making of Simple component. 4. Performance on Metal Casting of Simple component. 5. Performance on Welding of simple work piece (Example Arc Welding) 6. Performance on Sheet Metal work of Simple component. 7. Performance on hot forging of Simple component	1.Investigation of gyroscopic couple for self-balancing vehicle 2.Understanding of balancing and alignment 3. Development of various toy mechanism 4. Understanding of Gear based quick return mechanism. 5.Investigation and understanding of geared cycle. 6. Understanding of gear mechanism used in watch. 7.Design of easy (make/use) cycle. 8.Working model of epicyclical gear train. 9.Investigation and understanding of sports cycle.

Item ME15

To review and finalize the scheme and syllabi of B. Tech. II Semester **(for batch admitted in 2023-24)** under the flexible curriculum along with their COs.

S.No.	Subject Code	Category	Subject Name
1.	3120221	DC	Material Science
2.	3120222	DC	Manufacturing Processes
3	3120223	DC	Engineering Thermodynamics
4	3100014	ESC	Engineering Graphics
5	3160222	ESC	Python Programming
6	3100024	ESC	Manufacturing Practices
7	3100018	ESC	Engineering Graphics Lab
8.	3000004	Natural Sciences	Language

Item ME16

To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in Batch II semester **(for batch admitted in 2023-24)**

3100026: Basic Mechanical Engineering Lab	**3100018: Engineering Graphics Lab**	**3100024: Manufacturing Practices**

	1. Study of vertical boilers. 2. Study of Locomotive boilers. 3. Study of Babcock and Wilcox boilers. 4. Study of Lancashire, Cornish and Cochran boilers. 5. Study of boiler mounting and accessories. 6. Study of 2 stroke diesel and petrol engines. 7. Study of 4 stroke diesel and petrol engines. 8. Study of steam engines. 9. Study of Lathe machine. 10. Study of Vernier and Micrometer. 11. Study of Internal Combustion Engine Parts.	1. To prepare sheet of Plain scale, diagonal scale and Scale of chord. 2. To prepare sheet of Cycloidal curves. 3. To prepare sheet of Projection of points and lines. 4. To prepare sheet of Projection of Planes. 5. To prepare sheet of Projection of Solids. 6. To prepare sheet of Section of Solids. 7. To prepare sheet of Development of Surfaces. 8. To prepare sheet of Isometric and Intersection of Solids	To draw diagram of different tools used in different shops. 2. To prepare T joint in carpentry shop. 3. To prepare flat surface of given workpiece in fitting shop. 4. To prepare mould in foundry shop. 5. To prepare casting of given material in prepared mould. 6. To prepare screw driver and ring in welding shop.

Item ME17

To review and finalize the suggestive list of projects which can be offered under the **'Skill based mini-project'** category in various laboratory components based courses to be offered in B. Tech II Semester ***(for the batch admitted in 2023-24)***.

3100026: Basic Mechanical Engineering Lab	3100018: Engineering Graphics Lab	3100024: Manufacturing Practices
1.Measurement and calibration using slip gauges 2.Performing energy audit using stroboscope and lux meter 3.Make a Free energy Steam Engine at home 4.Make an Air Compressor at home 5.Mini Bench Tapping machine project 6.Make a Robotic Arm 7.Tornado in a bottle 8.Make a Hydraulic Lift 9.Thermal Expansion project 10.Make a positive displacement pump 11.Make a mini thermal power plant 12.Make a fire hydrant. 13.How an airplane wing creates lift and how wind turbine blades are spun by the wind. Make a model. 14.To make a model for measuring the pressure distribution in a convergent – divergent duct to confirm Bernoulli's equation. 15.Make a digital hydraulic bench. 16.To make a model for induced draught and natural draught	1. To prepare the 3D view of any object. 2. To Prepare scale for your home and make a map using this scale. 3. To prepare cut section models drawing of any object. 4. To make paper object, cut and show the development of surfaces. 5. To make 3D drawing of five objects in Auto CAD.	1. Design and simulation of venting passages to prevent blow hole defect. 2. Development of low-cost experimental setup to study metal flow through gating channels. 3. Preparation of different types of patterns by using wax/wood material. 4. Fabrication of working model of brazing and soldering setup. 5. Preparation of educational wooden model of different types of furnaces. 6. Working model of the coining machine and prepare the die for the coining. 7. Fabrication of plastic injection molding machine by using extrusion principle. 8. Preparation of educational model of powder metallurgy setup. 9. Demonstration model of MIG and TIG setup. 10. Battery operated working model of lathe machine. 11. Working setup of Arduino CNC plotter. Working model of foot operated hammering machine for forging purpose.

Item ME18	To review the CO attainments, identify gaps and suggest corrective measures for the improvement in the CO attainment levels for the courses taught in **Jan-June 2023 Session.** **Compiled**
Item ME19	To review the PO attainment, CO-PO mapping matrix and action to be taken to improve PO attainment level. **Compiled**
Item ME20	To review curricula feedback from various stakeholders, its analysis and impact. **Compiled**

Dept. of Mechanical Engineering BoS 01/12/2023

Item ME21

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

S.No.	Subject Code	Subject Name
1.	560211	Automation & Robotics
2.	560212	Production Engineering-II
3.	560213	Logistics and Supply Chain Management
4.	DE-2	#Elective-II
5.	OC-2	##Open Category Course -2 (OC-2)
6.	560220	Production Engineering Lab-II
7.	560221	$Self Learning / Presentation

Departmental Elective –I (DE-II)*	Open Category course (OC-2)**
560214: Quality Design and Control	800210 : Introduction to Operations Management
560215: Traditional and Non-Traditional Optimization Tools	800211 : Tools in Scientific Computing
560216: Product Design and Manufacturing	: Manufacturing Guidelines for Product Design
560217: Material characterization	

Item ME22

To recommend the scheme structure and Syllabus of Ph.D. Course Work (specific to Doctoral Research Scholars, if any)

NA

Item ME23

Any other matter.

NA

Dr. Gavendra Norkey (BoS Member)

Dr. Nitin Upadhyay (BoS Member)

Dr. Surendra Ku. Chourasiya (BoS Member)

Mr. B. K. Pandey (BoS Member)

Dr. Amit Ahirwar (BoS Member)

Mr. V. Shivhare (BoS Member)

Mr. Sharad Agrawal (BoS Member)

Dr. Jyoti Vimal (BoS Member)

Mr. V. Chaturvedi (BoS Member)

Mr. R. P. Kori (BoS Member)

Dr. C. S. Malvi (BoS Member)

Dr. M. K. Sagar (BoS Member)

Dr. Pratesh Jayaswal (BoS Member) 1/12/2023

online Present
Er. Amit Lahariya (Alumni)

online Present
Er. Anil Gupta (Industry Expert)

on-line Present
Dr. A. K. Tiwari (AC Nominee)

Absent
Dr. Mukul Shukla (AC Nominee)

online Present
Dr. Prashant Kumar Jain (RGPV Nominee)

28/2/2024.
DEAN (ACADEMICS)
M.I.T.S
GWALIOR

Dr. M. K. Gaur (BoS Chairman) 1/12/2023

Item ME3	To propose the scheme structure of **VIII Semester** with the provision of **ONE DE & ONE OC course** to be offered in **online mode** with credit transfer for the batch admitted in academic year 2020-21. **(The total credits from I-VIII semester should not be less than 160 for this batch).**

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03/01/2024
DEAN (ACADEMICS)
M.I.T.S

Department of Mechanical Engineering
Scheme of Evaluation
B. Tech. VIII Semester (Automobile Engineering)

(For batch admitted in academic session 2020-21)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Online, Offline, Blended)	Mode of Exam.
				Theory Slot				Practical Slot			MOOCs								
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Assignment	Exam		L	T	P			
				End Sem. Exam.	*Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project									
1.	DE	DE	Departmental Elective* (DE-5)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Blended	MCQ
2.	OC	OC	Open Category* (OC-3)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Blended	MCQ
3.	190811	DLC	Internship/Research Project/ Innovation & Start-up	-	-	-	-	250	150	-	-	-	400	-	-	18	9	Blended	SO
4.	190812	PD	Professional Development	-	-	-	-	50	-	-	-	-	50	-	-	4	2		
Total				-	-	-	-	300	150	-	50	150	650	6	-	22	17	-	-
Additional Course for Honours or minor Specialization				**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**															

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

*All of these courses will run through SWAYAM/NPTEL/ MOOC with credit transfer

Evaluation will be based on participation/laurels brought by the students to the institution in national/state level technical and other events during the complete tenure of the UG programme (participation in professional chapter activities, club activities, cultural events, sports, personality development activities, collaborative events, MOOCs, technical events, institute/department)

S.No.	*DE-5 (SWAYAM/NPTEL/ MOOC platform)		*Open Category (OC-3) (SWAYAM/NPTEL/ MOOC platform) (For students of other branches)	
1	190861	Fundamentals of Theoretical and Experimental Aerodynamics		Theory and Practice of Non-Destructive Testing
2	190862	Experimental Stress Analysis		Product Design and Manufacturing
				Automatic Control

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Department of Mechanical Engineering

Scheme of Evaluation

B. Tech. VIII Semester (Mechanical Engineering)

03/12/2024

DEAN (ACADEMICS)

MITS

(for batch admitted in academic session 2020-21)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Online, Offline, Blended)	Mode of Exam.
				Theory Slot				Practical Slot			MOOCs			L	T	P			
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Assignment	Exam							
				End Sem. Exam.	*Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project									
1.	DE	DE	Departmental Elective* (DE-5)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Blended	MCQ
2.	OC	OC	Open Category* (OC-3)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Blended	MCQ
3.	120811	DEC	Internship/Research Project/ Innovation & Start-up	-	-	-	-	250	150	-	-	-	400	-	-	18	9	Blended	SO
4.	120812	PD	Professional Development	-	-	-	-	50	-	-	-	-	50	-	-	4	2		
Total				-	-	-	-	300	150	-	50	150	650	6	-	22	17	-	-
Additional Course for Honours or minor Specialization				Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization															

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

*All of these courses will run through SWAYAM/NPTEL/ MOOC with credit transfer

Evaluation will be based on participation/ laurels brought by the students to the institution in national/state level technical and other events during the complete tenure of the UG programme (participation in professional chapter activities, club activities, cultural events, sports, personality development activities, collaborative events, MOOCs, technical events, institute/department)

S.No.	*DE-5 (SWAYAM/NPTEL/ MOOC platform)		*Open Category (OC-3) (SWAYAM/NPTEL/ MOOC platform) (For students of other branches)
1	120861	Quality Design and Control	Theory and Practice of Non-Destructive Testing
2	120862	Robotics: Basics and Selected Advanced Concepts	Product Design and Manufacturing
3	120863	Carbon Materials and Manufacturing	Automatic Control

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ITEM ME4	To propose the list of courses which the students can opt from SWAYAM/NPTEL/ other MOOC Platforms/ Institution (MITS) MOOC, to be offered in online mode under **Departmental Elective (DE) category courses (DE-5) and open category (OC3)** for credit transfer in the **VIII Semester** under the flexible curriculum (Batch admitted in academic year 2020-21)

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190861: Fundamentals of Theoretical and Experimental Aerodynamics

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Departmental Elective-DE 5	Fundamentals of Theoretical and Experimental Aerodynamics	190861	3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: -
https://onlinecourses.nptel.ac.in/noc24_ae04/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jan 2024	12 Apr 2024	27 Apr 2024	12 Weeks

COURSE LAYOUT

Week 1: Aerodynamics-relevance and applications ,Atmosphere · Flow velocity, pressure, skin friction ,Generation of aerodynamic forces and moments on an aircraft, Aircraft external shape andsurfaces

Week 2: Eulerian and Lagrangian perspectives of flow, Fluid Kinematics, Conservation equations of mass, momentum and energy

Week 3: Inviscid and viscous flows- potential flow, boundary layer, Compressible and incompressible flow, Laminar and turbulent flow

Week 4: Airfoil geometry, Pressure distribution at an angle of attack (α), Aerodynamic centre, centre of pressure, Cl- α, Cl-Cd, Cm-α curves, Flow separation and stall, High lift devices, multi element airfoils, Laminar and turbulent flow over airfoil, Trailing edge noise

Week 5: Finite wing geometry, Control surfaces on wing, horizontal and vertical stabilizers, Airfoil and finite wing aerodynamics- a comparison, · Delta wing, high angle of attack aerodynamics, Unsteady effects in airfoils and wings- effect of gust, sudden change in angle of attack, Pitch, heave, flapping, leading edge vortex, dynamic stall

Week 6: Full Potential Equation and its application, Shock and expansion wave theory, Supersonic flow past a flat plate, Flow through a converging diverging nozzle, Transonic and supersonic flow past airfoil, Shock wave boundary layer interaction, Shock tube, Preliminary concepts of hypersonic flow

Week 7: Computing aerodynamic flows- main steps and resources, Panel and Vortex Lattice Method, Euler and Navier Stokes equations-I

Week 8: Euler and Navier Stokes equations-II, What information can be extracted from numerical solutions, Applications of computational aerodynamics- few examples

Week 9: Wind Tunnel: experimental tool in Aerodynamics, Types of wind tunnels, Wind Tunnel design basics, Similarity analysis, Scaling of wind tunnel models, Safety issues in wind tunnel handling

Week 10: Flow visualization techniques, Model design and fabrication, Model positioning system, Measurements involving mechanical sensors, Pressure ports, Pitot static tubes,

Mechanical balances

Week 11: Measurements involving electronic transducers, Electronic pressure gages, Strain gage based balances, Data Acquisition System and software, Measurement uncertainty

Week 12: Velocity measurement using Particle Image Velocimetry, How wind tunnel and associated instrumentation are used for performing aerodynamic studies- few examples, Quick revision of course content & doubts clarification

Books and references

- Fundamentals of Aerodynamics: J. D. Anderson,
- McGrawHill Introduction to Flight: J. D. Anderson, McGrawHill
- Low Speed Wind Tunnel Testing: J. B. Barlow, W. H. Rae, Alan Pope, Wiley-Interscience
- A First Course in Aerodynamics: A. Roy, Ventus Publishing, Denmark
- EL-Halwagi, M.M., "Biogas Technology- Transfer and Diffusion", Elsevier Applied Science.
- Hall, D.O. and Overeed, R.P.," Biomass - Renewable Energy", John Willy and Sons.
- Mondal, P. and Dalai, A.K. eds., 2017. Sustainable Utilization of Natural Resources. CRC Press.

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190862: Experimental stress Analysis

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Departmental Elective-DE5	Experimental stress Analysis	190862	3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_me04/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jan 2024	12 Apr 2024	28 Apr 2024	12 Weeks

Course layout

Week 1 : Overview of Experimental Stress Analysis
Week 2 : Physical Principle of Experimental Techniques, Introduction to Various experimental Techniques
Week 3 : Fringe Patterns – Richness of Qualitative Information, Multi Scale Analysis
Week 4 : Selection of Experimental Techniques, Introduction to Crystal Optics
Week 5 : Light Ellipse, Retardation Plates and Plane Polariscope
Week 6 : Jones Calculus, Plane and Circular Polariscope analysis
Week 7 : Compensation Techniques, Calibration of Photo-elastic Materials
Week 8 : Fringe ordering and Three-Dimensional Photo-elasticity
Week 9 : Photo-elastic Coatings
Week10 : Brittle Coatings and Strain Gauges Introduction
Week11 : Strain Gauge Alloys, Performance of Strain Gauge System
Week12 : Correction factor for Special Applications

Books and references

1. K. Ramesh, Developments in Photoelasticity - A renaissance. IOP Publishing, 2021. DOI: https://doi.org/10.1088/978-0-7503-2472-4

2. K. Ramesh, P_Scope® – a virtual polariscope, Photomechanics Lab, IIT Madras,2017. URL: https://home.iitm.ac.in/kramesh/p_scope.html

3. K. Ramesh, e-Book on Experimental Stress Analysis, IIT Madras, 2009. URL: https://home.iitm.ac.in/kramesh/ESA.html

4. K. Ramesh, Digital Photoelasticity – Advanced Techniques and Applications, Springer, 2000. DOI: https://doi.org/10.1007/978-3-642-59723-7

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120861: Quality Design and Control

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Departmental Elective-DE 5	Quality Design and Control	120861	3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_mg50/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jan 2024	12 Apr 2024	20 Apr 2024	12 Weeks

Course layout

Week 1: History and Evolution of Quality Control and Management
Week 2: Management of Quality-I
Week 3: Management of Quality-II
Week 4: Statistical Process Control-I
Week 5: Statistical Process Control-II
Week 6: Process Capability Analysis
Week 7: Acceptance Sampling-I
Week 8: Acceptance Sampling-II
Week 9: Design for Reliability-I
Week 10: Design for Reliability-II
Week 11: Quality by Experimental Design
Week 12: Robust Design and Taguchi Method

Books and references

- Mitra, A. Fundamentals of Quality Control and Improvement, Prentice-Hall, 2nd Edn (1998), ISBN: 0-13-645086-5.
- Dukkipati, R V and Pradip K Ray, Product and Process Design for Quality, Economy and Reliability, New Age International, 1st Edn. (2010), ISBN: 978-81-224-2661-8.

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120862: Robotics: Basics and Selected Advanced Concepts

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Departmental Elective-DE 5	Robotics: Basics and Selected Advanced Concepts	120862	3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https: /onlinecourses.nptel.ac.in/noc24_me23/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jan 2024	12 Apr 2024	28 Apr 2024	12 Weeks

Course layout
Week 1: Introduction, Elements of a robot
Week 2: Mathematical preliminaries, D-H convention, Examples
Week 3: Direct and Inverse kinematics of serial robots, Workspace, Analytical and numerical solutions
Week 4: Parallel robots – direct and inverse kinematics, Mobility, Stewart-Gough platform
Week 5: Applications of parallel robots in sun tracking, vibration isolation
Week 6: Velocity analysis, Singularities in serial and parallel robots, Statics
Week 7: Redundancy and resolution of redundancy in robots
Week 8: Dynamic equations of motion, derivation & simulation using Matlab
Week 9: Motion planning, Introduction to linear control, simulations & experiments
Week 10: Nonlinear position and force control of robots, Simulations
Week 11: Wheeled mobile robots, modeling and simulations
Week 12: Over-constrained and deployable structures, Cable driven & pneumatically actuated flexible robots

Books and references
Robotics: Fundamental Concepts and Analysis, Oxford University Press, 2006

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120863: Carbon Material and Manufacturing

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Departmental Elective-DE 5	Carbon Material and Manufacturing	120863	3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course:

https://onlinecourses.nptel.ac.in/noc24_mm07/preview

The details of the course are mentioned below :-

Course Start Date	Course End Date	Exam date	Duration
22 Jan 2024	12 Apr 2024	21 Apr 2024	12 Weeks

Course layout

Week 1: Introduction to materials and manufacturing, mathematical representation of material properties, introduction to carbon, carbon on the Earth and in outer space, carbon in technology and economy, carbon isotopes, carbon atomic structure and hybridization

Week 2: Diamond, graphite, carbyne and curved carbons, classification of carbon allotropes, conversion of one allotropic form into another, phase diagram of carbon

Week 3: Engineering carbons, graphite crystal structure, stacking faults and rhombohedral graphite, graphite ore processing, synthetic graphite production from needle coke

Week 4: Kish graphite, polymer-derived graphite, Highly Oriented Pyrolytic Graphite (HOPG), pyrolysis of gaseous hydrocarbons, kinetics of graphitization, polymer-derived carbon: coking and charring mechanism

Week 5: Microstructure of non-graphitizing carbon, glass-like carbon: introduction, properties and industrial manufacturing, pyrolysis of polymers and other solid hydrocarbons, microfabrication with glass-like carbon

Week 6: Photolithography, X-Ray and Nano-Imprint Lithography, conversion of microfabricated structure into carbon, activated carbon: introduction, properties and industrial manufacturing

Week 7: Carbon black: introduction, properties and industrial manufacturing, carbon fiber: introduction and properties, melt spinning of petroleum pitches, electrospinning and viscoelasticity

Week 8: Carbonization of polyacrylonitrile (PAN) fibers, mechanical property testing methods for carbon fibers, defects in carbon fibers, Carbon Fiber Reinforced Plastic (CFRP), machining of CFRPs

Week 9: Carbon/ carbon, carbon/ metal and carbon/ concrete composites: Manufacture and Properties, graphene: introduction and crystal structure, graphene history and nomenclature, Chemical Vapor Deposition (CVD) of graphene

Week 10: Graphene CVD parameter optimization, defects in graphene, (n,m) notations, carbon nanotube: introduction and properties, vapor phase growth of carbon nanotube

Week 11: Vapor deposited diamond, diamond-like carbon, X-Ray Diffraction analysis of carbon, Raman **spectroscopy of carbon, Transmission Electron Microscopy of carbon**
Week 12: Gas adsorption isotherms and surface area analysis of porous carbons, numerical problem solving, large-scale industrial applications of carbon materials, micro and nano-scale applications of carbon materials, rigid and flexible carbon devices, device characteristics and challenges, supply chain of industrial carbons, summary and overview

Books and references

Jenkins, G. M. & Kawamura, K. Polymeric carbons--carbon fibre, glass and char. (Cambridge University Press, 1976).
Marsh, H. & Rodriguez-Reinoso, F. Activated carbon. (Elsevier, 2006).
Kinoshita, K. Carbon: electrochemical and physicochemical properties. (Wiley, 1988)

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Theory and Practice of non-Destructive Testing

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Open Category-OC-3	Theory and Practice of non-Destructive *Testing*		3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: - https://onlinecourses.nptel.ac.in/noc24_mm14/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jan 2024	15 Mar 2024	24 Mar 2024	8 Weeks

COURSE LAYOUT

Week 1: Introduction to NDT, Visual Optical methods, Dye penetrant testing, Basic principle, Types of dye and methods of application, Developer application and Inspection.
Week 2: Magnetic particle testing, Basic theory of magnetism, Magnetization methods, Field indicators, Particle application, Inspection.
Week 3: Eddy current testing, Basic principle; Faraday's law, Inductance, Lenz's law,Self and Mutual Inductance, Impedance plane, Inspection system and probes,System calibration.
Week 4: Ultrasonic testing: Basics of ultrasonic waves, Pulse and beam shapes,Ultrasonic transducers.
Week 5: Test method, Distance and Area calibration, Weld inspection by UT.
Week 6: Acoustic emission testing: Basic principle, Sources of acoustic emission, Source parameters, Kaiser-Felicity theory, Equipment and Data display, Source location schemes.
Week 7: Radiography: X-rays and their properties, X-ray generation, X-ray absorption and atomic scattering.
Week 8: Image formation, Image quality, Digital Radiography, Image interpretation, Radiation Shielding. Comparison and selection of NDT methods, Concluding remarks.

Books and references

1. Nondestructive Testing, Louis Cartz, ASM International
2. Nondestructive Evaluation and Quality Control, ASM Handbook, Vol. 17.
3. https://www.nde-ed.org

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Product Design and Manufacturing

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Open Category-OC-3	Product Design and Manufacturing		3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: - https://onlinecourses.nptel.ac.in/noc24_me58/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jan 2024	12 Apr 2024	20 Apr 2024	12 Weeks

COURSE LAYOUT

Week 1 : Introduction to Product Design and Manufacturing
Week 2 : Product Design Morphology
Week 3 : Visual Design, and Quality Function Deployment (QFD)
Week 4 : Value Engineering
Week 5 : Material, and Manufacturing process selection
Week 6 : Design for Manufacturing, Assembly, and Maintenance
Week 7 : Design for Environment, and Quality Control
Week 8 : Patenting, and Creativity
Week 9 : Rapid Prototyping
Week 10 : Plant Layout Design
Week 11 : Computer Integrated Manufacturing
Week 12 : Reverse Engineering, and Managing Competitiveness

Books and references

- Eppinger, S. and Ulrich, K., 2015. Product design and development. McGraw-Hill Higher Education
- Magrab, E.B., Gupta, S.K., McCluskey, F.P. and Sandborn, P., 2009. Integrated product and process design and development: the product realization process. CRC Press.
- Boothroyd, G., 1994. Product design for manufacture and assembly. Computer-Aided Design, 26(7), pp505-520.

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Automatic Control

Category	Title	Code	Credit - 3			Theory Paper
Open Category-OC-3	Automatic Control		L	T	P	As per SWAYAM/NPTEL norms
			3	-	-	

SWAYAM/NPTEL Link for the course: - https://onlinecourses.nptel.ac.in/noc24_me06/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jan 2024	15 Mar 2024	24 Mar 2024	8 Weeks

COURSE LAYOUT

Week 1: Automatic Control System.
Week 2: Mathematical Modeling.
Week 3: Transient Response Analysis.
Week 4: Stability and Steady State Error.
Week 5: Root Locus Technique.
Week 6: Design via Root Locus and Compensation Techniques.
Week 7: State Space Method.
Week 8: Application of MATLAB in Automatic Control.

Books and references

- Nise, N.S., Control Systems Engineering, 5th Ed., Willey, 2008.
- Ogata, K., " Modern Control Engineering", 5th Ed., Prentice Hall of India, 2013.
- Kuo, B.C., "Automatic Control System", 5th Ed., Prentice Hall of India, 1995.
- Raven, F.H., "Automatic Control Theory", 5th Ed., McGraw Hill, 1995.

Item ME5	To propose the list of "Additional Courses" which can be opted for getting an Honours (for students of the host department) Minor Specialization (for students of other departments) **[These will be offered through SWAYAM/NPTEL/MOOC based Platforms for the B.Tech. VIII semester students (for the batch admitted in 2020-21)] and for B.Tech. VI semester (for the batch admitted in 2021-22)]**

Honor's	Minor Specialization	Minor Specialization
VIII (for the batch Admitted in 2020-21)	VIII (for the Batch admitted in 2020-21)	VI (for the Batch admitted in 2020-21)
Computer integrated Manufacturing (12 Weeks)	Computational Fluid Dynamics for Incompressible Flows (12 weeks)	Fundamental of Combustion (12weeks)
Solar Photovoltaic: Principles, Technologies & Materials (8 weeks)	Mechanics of Machining (8 weeks)	Introduction to Mechanical Micro Machining (12 weeks)
Oil Hydraulics and Pneumatics (12 weeks)		

2021 admitted batch Tracks (Jan-June 2024)			
Sr No.	Design Track	Thermal Track	Production Track
	Honors (Jan.-June)	Honors (Jan.-June)	Honors (Jan.-June)
1	Design, Technology and Innovation (8 week)	Computational Fluid Dynamics for Incompressible Flows(12 Weeks)	Introduction To Mechanical Micro Machining (8 weeks)
2	Experimental Stress Analysis (12 weeks)	Turbulent Combustion: Theory And Modelling (12 weeks)	Product Design and Manufacturing (12 weeks)
3	Robotics: Basics and Selected Advanced Concepts(8 weeks)	Experimental Methods in Fluid Mechanics(12 Weeks)	Mechanics of Fiber Reinforced Polymer Composite Structures(12 weeks)
4	Modeling and Simulation of Dynamic Systems(8 Weeks)	Heat Transfer and Combustion in Multiphase Systems (8 Weeks)	Fundamentals of Electronic Materials And Devices (8 weeks)

Item ME6	To review and finalize the **scheme structure of B.Tech VI Semester under** the flexible curriculum **(Batch admitted in 2021-22)**

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Department of Mechanical Engineering
Scheme of Evaluation
B. Tech. VI Semester (Mechanical Engineering)

MD DEAN (ACADEMICS) 03/12/24

(For batch admitted in academic session 2021-22)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam.
				Theory Slot				Practical Slot			MOOCs			L	T	P			
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Assignment	Exam							
				End Sem Exam.	Proficiency in subject course	Mid sem Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project									
1.	120615	DC	Mechanical Vibrations (DC-12)	50	10	20	20	60	20	20	-	-	200	2	1	2	4	Blended	PP
2.	120616	DC	Refrigeration and Air Conditioning (DC-13)	50	10	20	20	60	20	20	-	-	200	2	1	2	4	Blended	PP
3.	DE	DE	Department Elective* (DE-3)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ
4.	OC	OC	Open Category (OC-1)**	50	10	20	20	-	-	-	-	-	100	3	-	-	3	Blended	PP
5.	120617	MC	Artificial Intelligence & Machine Learning	50	10	20	20	60	20	20	-	-	200	3	-	2	4	Blended	MCQ
6.	120618	DLC	Minor Project-II	-	-	-	-	60	40	-	-	-	100	-	-	4	2	Offline	SO
7.	200XXX	CLC	Naval Engg/any Course (Informal Learning)	-	-	-	-	50	-	-	-	-	50	-	-	2	1	Blended	SO
	Total			200	40	80	80	290	100	60	25	75	950	13	2	12	21	-	-
8.	1000007	MAC	Intellectual Property Rights (IPR)	50	10	20	20	-	-	-	-	-	100	2	-	-	GRADE	Online	MCQ
Summer Internship-III (On Job Training) for Four weeks duration: Evaluation in VII Semester																			
Additional Course for Honours or minor Specialization				Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization															

$^{\$}$proficiency in course/subject-includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject.
$^{\$\$}$MCQ: Multiple Choice Question $^{\$\$}$AO: Assignment + Oral $^{\$\$}$PP: Pen Paper $^{\$\$}$SO: Submission + Oral
'Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform with credit transfer
'' Course run in traditional mode

*This course run through SWAYAM/NPTEL/ MOOC platform

S.No.	*DE-I (SWAYAM/NPTEL/ MOOC platform)		**Open Category (OC-1)(For students of other branches)	
	Code	Subject	Code	Subject
1	120661	Fundamental of Welding Science and Technology	910129	Concepts of Mechanical Systems
2	120662	Virtual Fluid Flow	910130	Digital Manufacturing
3	120663	Properties of Materials (Nature and Properties of Material -IIIs	910131	Process Planning and Cost Estimations

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Department of Mechanical Engineering
Scheme of Evaluation
B. Tech. VI Semester (Automobile Engineering)

05/12/24
DEAN (ACADEMICS)

(for batch admitted in academic session 2021-22)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted									Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	$^{\$\$}$Mode of Exam.
				Theory Slot				Practical Slot			MOOCs			L	T	P			
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Assignment	Exam							
				End Sem. Exam.	$^{\$}$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project									
1.	190615	DC	Automotive Transmission (DC-13)	50	10	20	20	60	20	20	-	-	200	2	1	2	4	Blended	PP
2.	190616	DC	Refrigeration and Air-Conditioning (DC-14)	50	10	20	20	60	20	20	-	-	200	2	1	2	4	Blended	PP
3.	DE	DE	Departmental Elective* (DE-1)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ
4.	OC	OC	Open Category (OC-1)**	50	10	20	20	-	-	-	-	-	100	3	-	-	3	Blended	PP
5.	190617	MC	Artificial Intelligence & Machine Learning	50	10	20	20	60	20	20	-	-	200	3	-	2	4	Blended	MCQ
6.	190618	DLC	Minor Project-II	-	-	-	-	60	40	-	-	-	100	-	-	4	2	Offline	SO
7.	200XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	-	-	50	-	-	2	1	Blended	SO
Total				**200**	**40**	**80**	**80**	**290**	**100**	**60**	**25**	**75**	**950**	**13**	**2**	**12**	**21**	-	-
8.	1000007	MAC	Intellectual Property Rights (IPR)	50	10	20	20	-	-	-	-	-	100	2	-	-	GRADE	Online	MCQ
Summer Internship-III (On Job Training) for Four weeks duration: Evaluation in VII Semester																			
Additional Course for Honours or minor Specialization				**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**															

$^{\$}$proficiency in course/subject-includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject.
$^{\$\$}$MCQ: Multiple Choice Question $^{\$\$}$AO: Assignment + Oral $^{\$\$}$PP: Pen Paper $^{\$\$}$SO: Submission + Oral
*Course run through SWAYAM/NPTEL/ MOOC Learning Based Platform with credit transfer
** Course run in traditional mode

*This course run through SWAYAM/NPTEL/ MOOC platform

S.No.	*DE-1 (SWAYAM/NPTEL/ MOOC platform)		**Open Category (OC-1)(For students of other branches)	
	Code	Subject	Code	Subject
1	19661	Fundamentals of Automotive Systems	910129	Concepts of Mechanical Systems
2	19662	Vehicle Fluid Flow	910130	Digital Manufacturing
3			910131	Process Planning and Cost Estimation

Item ME7	To review & finalize the syllabi for all Departmental Core Courses (DC) and Mandatory Course (MC) of B. Tech VI Semester (for batch admitted in 2021-22) under the flexible curriculum along with their COs.

120615: Mechanical Vibrations

Category	Title	Code	Credit - 4			Theory Paper
			L	T	P	
Departmental Core - DC	Mechanical Vibrations	120615	2	1	2	Max.Marks-50 Duration-2 hrs.

Prerequisite: Engineering Mathematics, Engineering Mechanics

Course Objectives:

1. To impart basic knowledge and importance on Mechanical Vibration in Engineering Fields among the students.
2. To create the awareness on Mechanical Vibration in Research and Application area

Syllabus

Unit-I:

Introduction: Importance and scope of vibrations, Definitions, Types of vibrations, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier transform and problems.

Undamped (Single Degree of Freedom) Free Vibrations: Derivations for spring mass systems, Methods of analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.

Unit-II:

Damped free vibrations (1DOF): Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.

Whirling of shafts: Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.

Unit-III Forced Vibrations (1DOF)

Introduction, Analysis of forced vibration with constant harmonic excitation - magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.

Unit-IV

Systems with two degrees of Freedom:

Principle modes of vibrations, Normal mode and natural frequencies of systems (without damping), Torsional system, Semidefinite system

Multi Degree Freedom System: Free Vibration equation of motion, Stiffness influence coefficients, , flexibility influence coefficient, inertia influence coefficient

Unit V

Numerical Methods: Dunkerley's Methods, Rayleigh's Method, Holzer's Method, Methods of Matrix iterations, Jacobi's method

Vibration Control: Transducers and vibration pickup, Vibrometer, accelerometer, velometer, frequency measuring instrument, FFT analyser, vibration exciters.

Course Outcomes: After completing this course students are able to:

1. Compute the dynamic behaviours of physical systems under simple harmonic motion
2. Derive equations of motion for un-damped one-dimensional vibrations

3. Analyze problems of forced vibrations involving frequency response curves, phase angle plots, vibration isolation and transmissibility
4. Analyze normal modes and natural frequencies of systems with two degrees of freedom
5. Design vibration measurement systems for engineering applications

Text Books:

1. Grover, G.K., " Mechanical Vibrations", 7th Ed., Nem Chand & Bros.
2. Rao, S.S., " Mechanical Vibrations", 5th Ed., Addison-Wesley Longman, Incorporated.

References Books:

1. Theory of Vibrations with Applications: W T Thomson CBS Publishers Delhi
2. Fundamentals of Vibration: Leonard Meirovitch , McGraw Hill International Edison.
3. Principles of Vibration Control: Asok Kumar Mallik, Affiliated East-West Press.
4. Mechanical Vibrations A H Church ,John Wiley & Sons Inc
5. Mechanical Vibrations J P Den Hartog ,McGraw Hill.
6. Mechanical Vibration Analysis: Srinivasan ,McGraw Hill.

List of Experiments

1. To verify the relation of simple pendulum.
2. To determine the radius of gyration of given compound pendulum.
3. To study undamped free vibration of equivalent spring mass system.
4. To study the torsional vibration of single rotor system
5. To study damped free vibration of equivalent spring mass system.
6. To study the damped torsional oscillation.
7. To study the forced vibration of spring mass system
8. To study the free vibration of Two rotor system.
9. To determine the whirling of shaft.
10. To verify the Dunkerley's rule.

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120616/190616: Refrigeration and Air-conditioning

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core -DC	Refrigeration and Air-conditioning	120616/190616	2	1	2	Max.Marks-50 Duration-2 hrs

Course Objectives: To make the students to understand

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

Pre-requisite: Engineering Thermodynamics

Syllabus

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

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

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

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

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

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

1. Identify components and processes involved in air refrigeration cycles
2. Analyze the working principles and limitations of standard Vapour Compression Refrigeration systems.

3. Evaluate the performance of different refrigeration system equipment like compressors, condensers, etc.
4. Interpret psychrometric properties and processes using psychrometric charts.
5. Develop strategies for optimizing air-conditioning systems based on specific requirements and conditions.

List of Experiments (Expandable):

1. Demonstration of fundamental study of Absorption Refrigeration System.
2. To study Performance of Ice-Candy unit.
3. Demonstration of C.O.P. and Performance of Air-Conditioner.
4. Demonstration of fundamental study of Vapour Compression cycle (Ice candy Unit)
5. Determination of C.O.P. in Vapour compression Refrigeration system.
6. Demonstration of Electrolux Refrigerator.
7. Equipment and controls of Refrigeration Systems.
8. Equipment and controls of Air Conditioning Systems
9. To study duct and induct type AC
10. To study refrigeration and fault simulator
11. Demonstration of C.O.P. and other performance parameters for Mech. Heat Pump.
12. Demonstration of C.O.P. and other performance parameters for Mech. Heat Pump.

Text Books:

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

References Books:

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

Academic session 2021-22 admitted

190615: Automotive Transmission

Category	Title	Code	Credit-4			Theory Paper
Departmental Core-DC	Automotive Transmission	190615	L	T	P	Max.Marks-50
			2	1	2	Duration-2 hrs.

Course Objectives

To make the students:
1. develop the basic knowledge of the students in mechanics, torque conversion areas.
2. understand various transmission system.
3. develop the skills to work in the areas of alternative drives.

Syllabus

UNIT -I TRANSMISSION REQUIREMENTS:
Requirements of transmission system, general arrangement of power transmission, general arrangement of rear-engine vehicle with live axles, general arrangement of dead- axle and axles transmission; four-wheel-drive transmission.

UNIT -II CLUTCHES:
Clutches Requirements of clutches, principle of friction clutches, types of clutches and materials used-cone, single-plate, diaphragm-spring, multi-plate, centrifugal, over-running and electromagnetic clutch.

UNIT -III GEAR BOX:
Need of gear boxes, types- sliding mesh, constant mesh and epicyclic, gear boxes;
Synchronizers: principle, early and later Warner synchronizer, Vauxhall synchronizer- gear materials lubrication and design of gear box; Hydrodynamic drive: Advantages and limitations, principle of fluid coupling, constructional details, torque-capacity performance characteristics, drag torque, methods of minimizing drag torque; Torque converter: performance characteristics; single, multistage and poly phase torque converters, converter-coupling-performance characteristics, coupling-blade angle and fluid flow, converter fluid.

UNIT-IV TRANSMISSION SYSTEMS-DRIVE LINE:
Definition, forces & torques acting; types of drives-Hotchkiss, torque tube & radius rod drives; components- propeller shaft, slip joint, universal joints & constant velocity universal joints; front wheel drive; Final drive: definition; types- worm-wheel, straight-bevel gear, spiral-bevel gear & hypoid-gear drives; double-reduction & twin-speed final drives; Differential: Function, principle, construction and working; non-slip differential; differential lock; rear axle- loads acting & types; multi-axled vehicles.

UNIT –V AUTOMATIC TRANSMISSION:

Chevrolet "turbo glide" transmission, power glide transmission, hydraulic control system of automatic transmission; Electric drive: advantages and limitations, principle of early and modified Ward-Leonard system, modern electric drive for buses; performance characteristics.

Course Outcomes:

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

1. Identify components and processes involved in air refrigeration cycles
2. Analyze the working principles and limitations of standard Vapour Compression Refrigeration systems.

3. Evaluate the performance of different refrigeration system equipment like compressors, condensers, etc.
4. Interpret psychrometric properties and processes using psychrometric charts.
5. Develop strategies for optimizing air-conditioning systems based on specific requirements and conditions.

Text & References Books:

1. Heldt P.M.; Torque converters; Chilton Book Co.
2. Giri NK; Automobile Engineering; Khanna Publisher
3. .Newton, Steeds & Garret; Motor Vehicles; B.H. Publication.
4. Judge, A.W., Modern Transmission Systems, Chapman & Hall Ltd.
5. Check Chart; Automatic Transmission; Harper & Row Publication.

List of Experiments:

1. Study of transmission of front and rear engine vehicles
2. Study of front and rear-wheel-drive vehicle
3. Study of four wheel-drive vehicles
4. Study of various gear boxes and pre synchronization systems
5. Study of fluid couplings, hydrodynamic drives and torque converters
6. Automatic transmission system study.

Laboratory Course Outcomes:

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

CO1: **Describe** the concept of gear motions, drive line positions.
CO2: **Explain** about different types of gearboxes.
CO3: **Know** about the multi stage and poly phase torque converters, performance characteristics.
CO4: **Demonstrate** about Automatic transmission.
CO5: **Learn** about the different drive systems.
CO6: **Apply** the mechanics of transmission system.

Item ME8	To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered (for batches admitted in 2021-22) in online mode under Departmental Elective (DE-1) Course with credit transfer, in the VI Semester.

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190661: Fundamentals of Automotive Systems

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Departmental Elective-DE 1	Fundamentals of Automotive System	190661	3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_de03/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jan 2024	12 Apr 2023	20 Apr 2024	12 Weeks

Course layout

Week 1 : Course Overview, Classification of Internal Combustion Engines, Engine Components, Operation of Four Stroke Engines
Week 2 : Two Stroke Engines, Engine Cycles
Week 3 : Engine Performance, Supercharging, Combustion in Spark Ignition Engines
Week 4 : Combustion in Compression Ignition Engines, Carburetion, Fuel Introduction Systems
Week 5 : Engine Emissions, Emission Control Systems, Automotive Powertrain
Week 6 : Automotive Clutch, Transmission, Powertrain Analysis
Week 7 : Transmission Matching and Introduction to Brake System
Week 8 : Components of Brake System, Hydraulic Brake
Week 9 : Air Brake, Antilock Brake System
Week 10 : Braking Analysis, Introduction to Steering System, Manual Steering System
Week 11 : Power Steering System, Wheel Alignment, Introduction to Suspension System
Week 12 : Components of Suspension System, Dependent and Independent Suspension, Introduction to Electric and Hybrid Powertrain, Tyres.

Books and references

- D. Crolla, D. E. Foster, T. Kobayashi and N. Vaughan (Editors-in-Chief), Encyclopedia of Automotive Engineering, Parts 1-6, Wiley, 2015.
- R. Stone and J. K. Ball, Automotive Engineering Fundamentals, SAE International, 2004.
- T. K. Garrett, K. Newton, and W. Steeds, The Motor Vehicle, 13th Edition, SAE International, 2001.
- D. B. Astow, G. Howard and J. P. Whitehead, Car Suspension and Handling, 4th Edition, SAE International, 2004.
- R. Limpert, Brake Design and Safety, SAE International, 1992.
- V. Ganesan, Internal Combustion Engines, 3rd Edition, Tata McGraw Hill, 2007.
- M. Ehsani, Y. Gao and A. Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, 2nd Edition, CRC Press, 2010.

190662/120662: Viscous Fluid Flow

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Departmental Elective-DE 1	Viscous Fluid Flow	190662/120662	3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_me66/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jan 2024	12 Apr 2024	28 Apr 2024	12 Weeks

Course layout

Week 1: Introduction
Week 2: Steady One-dimensional Rectilinear Flows
Week 3: Steady Axisymmetric Flows
Week 4: Transient One-dimensional Unidirectional Flows
Week 5: Steady, Two-dimensional Rectilinear Flows
Week 6: Lubrication Theory
Week 7: Laminar Boundary Layers - I
Week 8: Laminar Boundary Layers - II
Week 9: Laminar Free Shear Flows
Week 10: Stability Theory
Week 11: Turbulent Flows - I
Week 12: Turbulent Flows - II

Books and references

- White, F. M., Viscous Fluid Flow, McGraw-Hill, 2011.
- Papanastasiou, T. C., Georgiou, G. C., and Alexandrou, A. N., Viscous Fluid Flow, CRC Press, 2000.
- Sherman F. S., Viscous Flow, McGraw-Hill College, 1990.
- Ockendon H., and Ockendon J.R., Viscous Flow, Cambridge University Press, 1995.
- Schlichting, H., and Gersten, K., Boundary Layer Theory, Springer- Verlag, 2000.

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120661: Fundamentals of Welding Science and Technology

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Departmental Elective-DE 1	Fundamentals of Welding Science and Technology	120661	3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_me33/preview

The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
22 Jan 2024	15 Mar 2024	23 Mar 2024	8 Weeks

Course layout

Week 1 : Introduction and classification of welding
Week 2 : Nomenclature and symbol of welding joints
Week 3 : Power source of welding
Week 4 : Physics and principle of arc welding
Week 5 : Different type of welding methods and their details
Week 6 : Different type of welding methods their details
Week 7 : Different type of welding methods their details
Week 8 : Welding defects and inspection

Books and references

1. V. M. Radhakrishnan, Welding Technology and Design, New age, 2002.
2. Dr. O. P. Khanna, Welding Technology, Reprint: 2002.
3. J. A. Goldak, Computational Welding Mechanics, Springer 2005.
4. O. Grong, Metallurgical Modelling of Welding,2nd Ed. IOM publication , 1997.
5. L-E Lindgren, Computational Welding Mechanics, Woodhead Publishing Limited,2007.
6. J. F. Lancaster (Ed), The Physics of welding, Pergamon, 1986.
7. R.W. Messler, Principles of Welding, John Wiley and Sons,1999.

120663: Properties of Materials (Nature and Properties of Material: III)

Category	Title	Code	Credit - 3			Theory Paper
			L	T	P	
Departmental Elective-DE 1	Properties of Materials (Nature and Properties of Material: III)	120663	3	-	-	As per SWAYAM/NPTEL norms

SWAYAM/NPTEL Link for the course: https://onlinecourses.nptel.ac.in/noc24_mm18/preview
The details of the course are mentioned below:-

Course Start Date	Course End Date	Exam date	Duration
19 Feb 2024	12 Apr 2024	21 Apr 2024	8 Weeks

Course layout

Week 1 : Introduction and Basic Elasticity
Week 2 : Mechanical testing and plastic deformation
Week 3 : Plastic deformation mechanisms
Week 4 : Strengthening mechanisms
Week 5 : Electrical properties of metals
Week 6 : Quantum mechanics and band theory
Week 7 : Semiconductor properties
Week 8 : Thermal properties

Books and references

1. V. Raghavan, Materials Science and Engineering
2. W.D. Callister, Materials Science and Engineering
3. H.W. Hayden, W.G. Moffatt and J.W. Wulff, Mechanical Behaviour (Volume III: Structure and Properties of Materials)
4. L.F. Pease, R.M. Rose and J. Wulff, Electronic Properties (Volume IV: Structure and Properties of Materials)
5. A. Guinier and R. Julien, The Solid State

Item ME9	To review and finalize the courses & syllabi to be offered (for batch admitted in 2021-22) under the Open Category (OC) Courses (in traditional mode) for VI semester students of other departments along with their COs.

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910129: Concepts of Mechanical Systems

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Open Category	Concepts of Mechanical Systems	910129	3	-	-	Max.Marks-50 Duration-2 hrs.

Course objectives: To make the student to:

1. Develop the fundamentals of Engineering materials and reciprocating machines.
2. Develop an ability to understand the Thermodynamic laws, Fluid mechanics and Machine design concepts for solving engineering problems.
3. Understand the concept of measurement and production machines
3. Demonstrate Engines fundamentals using models.

Syllabus

UNIT-I:
Engineering Materials: Classification, composition of cast iron and carbon steels on iron-carbon diagram and their mechanical properties; Alloy steel and their applications; Stress-Strain diagram, Tensile, shear, hardness and fatigue testing of materials.

UNIT-II:
Measurement and Machine Tools: Concept of measurement error & uncertainty analysis, measurement by Vernier caliper, micrometer, dial gauges, slip gauges and sine-bar. Introduction to lathe drilling, milling and shaping machines.

UNIT-III
Fluids Mechanics and Hydraulic machines: Fluid properties: pressure, density and viscosity; static and kinetic energy; Bernoulli's equation for incompressible fluids, viscous and turbulent flow, Pelton, Francis and Kaplan turbines, Hydroelectric power plants

UNIT-IV
Thermodynamics and Reciprocating Machines: Zeroth, First, second and third law of thermodynamics, classification and working of water tube and Fire tube boilers, natural and induced draught, Refrigeration, vapour absorption and compression system, coefficient of performance (COP), Working of two stroke & four stroke petrol and diesel IC engines

UNIT-V
Design Concepts: Design process, Factor of safety, design standards and units, Material selection in Mechanical Design, Introduction to 2D and 3D modules, Concept of computer aided drafting and Machine drawing, Stress concentration, Fatigue- cyclic loading

Course outcomes: After successful completion of this course students will be able to:
1. Define the essential concepts of thermal, design and production used in Mechanical

Engineering.

2. **Summarize** fundamental techniques and process used in power generating machines
3. **Solve** the various problems based on basic concepts of various tracks of Mechanical Engineering
4. **Apply** the design procedure for solving and drafting the different design of machine elements
5. **Evaluate** the problems of Thermodynamics, Hydraulic machines and I.C. engine
6. **Generate** the skills to demonstrate Hydraulic machines and reciprocating machine in depth

Text & References Books:

1. Narula; Material Science; TMH
2. Agrawal B & CM; Basic Mechanical Engineering; TMH
3. Nag PK, Tripathi et al; Basic Mechanical Engineering; TMH
4. Rajput; Basic Mechanical Engineering
5. Bhandari VB, Design of Machine elements; Tata McGraw Hill Book Co
6. Machine Design by Mubeen, Pearson

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910130: Digital Manufacturing

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
OC	Digital Manufacturing	910130	3	-	-	Max.Marks-50 Duration-2 hrs.

Course Objectives: To make the student to understand:

1. The knowledge on the integrated use of automated system, processes and tools in design and manufacturing.
2. The basics of Additive manufacturing used in various industry applications. Further it will expose the students to additive manufacturing technology using 3-D printing.

Pre-requisite:

Syllabus

UNIT-I DIGITAL DESIGN AND MANUFACTURING FUNDAMENTALS: Elements of computer Aided design, Design Processes Creating manufacturing data base: The design Workstation, Graphics terminal, The software configuration of graphic packages, Constructing and Geo-modeling, Wire frame versus Solid Modeling.

UNIT-II ADDITIVE MANUFACTURING AND PROTOTYPING TECHNIQUES: From classical to Additive manufacturing, 3D Printers and Printable Materials, 3D Printer Workflow and Software, Selecting a Printer: Comparing Technologies, Working with a 3D Printer, 3D Models, Applications, Building Projects.

UNIT-III CNC TECHNOLOGY: Basic elements, Drive Mechanism, Main drive, feed drive, ATC, Control systems, Feedback devices, Input media and coding formats. Manual part programming for Lathe, Drilling and Milling machines, Computer assisted part programming languages APT, adaptive control.

UNIT-IV 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-V ROBOTICS IN DIGITAL MANUFACTURING: 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.

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

1. **Highlight** the knowledge of a 3D printer, how to use a 3D printer and how to assemble a 3D printer.
2. **Express** basic drawing skills to design simple 3D design using open source 3D drawing software (Free CAD).

3. **Choose** the components of computer integrated manufacturing and integrate them in a coordinated manner.
4. **Correlate** automated material handling systems, automated inspection systems and finally creating FMS.
5. **Assess** small robots and DIY projects where they can accommodate simple designs to printed parts and make it live.

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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910131 : Process Planning and Cost Estimation

Category	Title	Code	Credit -3			Theory Paper
			L	T	P	
Open Category-OC	Process Planning and Cost Estimation	910131	3	-		Max.Marks-50 Duration-2 hrs.

Course Objectives

1.To link design and manufacturing.

2. To determine the process and sequence of operations to obtain a useful final product. In companies, process planning is used to increase the output of the business.

Syllabus

UNIT I INTRODUCTION TO PROCESS PLANNING

Introduction- methods of process planning-Drawing Interpretation-Material evaluation – steps in process selection- Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods – Set of documents for process planning-Economics of process planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of overhead charges-Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION

Estimation of Different Types of Jobs – Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION

Estimation of Machining Time – Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations, Drilling and Boring – Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.

Course Outcomes

Upon the completion of this course the students will be able to

CO1. Select the process, equipment and tools for various industrial products.

CO2. Prepare process planning activity chart.

CO3. Explain the concept of cost estimation.

CO4. Compute the job order cost for different type of shop floor.

CO5. Calculate the machining time for various machining operations.

Text Books:

1. Peter scalon, "Process planning, Design/Manufacture Interface", Elsevier science technology Books, Dec 2002.

2. Sinha B.P. "Mechanical Estimating and Costing", Tata-McGraw Hill publishing co, 1995

Item ME10	To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B.Tech.VI semester ***(for batch admitted in 2021-22).***

Mechanical/Automobile Engg. VI Sem		
S.No.	Subject Code	Subject Name
1	120616/190616	Refrigeration and Air-conditioning
2	190615	Automotive Transmission
3	120615	Mechanical Vibration

120616/190616: Refrigeration and Air-conditioning

List of Experiments (Expandable):

1. Demonstration of fundamental study of Absorption Refrigeration System.
2. To study Performance of Ice-Candy unit.
3. Demonstration of C.O.P. and Performance of Air-Conditioner.
4. Demonstration of fundamental study of Vapour Compression cycle (Ice candy Unit)
5. Determination of C.O.P. in Vapour compression Refrigeration system.
6. Demonstration of Electrolux Refrigerator.
7. Equipment and controls of Refrigeration Systems.
8. Equipment and controls of Air Conditioning Systems
9. To study duct and induct type AC
10. To study refrigeration and fault simulator
11. Demonstration of C.O.P. and other performance parameters for Mech. Heat Pump.
12. Demonstration of C.O.P. and other performance parameters for Mech. Heat Pump.

Laboratory Course outcomes:

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

1. **Obtain** cooling capacity and coefficient of performance by conducting test on vapor compression refrigeration systems.
2. **Analyze** the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.
3. **Develop** thermal comfort conditions with respect to temperature and humidity

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190615: Automotive Transmission

List of Experiments:

1. Study of transmission of front and rear engine vehicles
2. Study of front and rear-wheel-drive vehicle
3. Study of four wheel-drive vehicles
4. Study of various gear boxes and pre synchronization systems
5. Study of fluid couplings, hydrodynamic drives and torque converters
6. Automatic transmission system study.

Laboratory Course Outcomes:

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

CO1: **Describe** the concept of gear motions, drive line positions.

CO2: **Explain** about different types of gearboxes.

CO3: **Know** about the multi stage and poly phase torque converters, performance characteristics.

CO4: **Demonstrate** about Automatic transmission.

CO5: **Learn** about the different drive systems.

CO6: **Apply** the mechanics of transmission system

120615: Mechanical Vibration

List of Experiments

1. To verify the relation of simple pendulum.
2. To determine the radius of gyration of given compound pendulum.
3. To study undamped free vibration of equivalent spring mass system.
4. To study the torsional vibration of single rotor system
5. To study damped free vibration of equivalent spring mass system.
6. To study the damped torsional oscillation.
7. To study the forced vibration of spring mass system
8. To study the free vibration of Two rotor system.
9. To determine the whirling of shaft.
10. To verify the Dunkerley's rule.

Item ME11	To review and finalize the suggestive list of projects which can be offered under the '**Skill based mini-project**' category in various laboratory components based courses to be offered in B.Tech. VI Semester **(for the batch admitted in 2021-22)**.

Mechanical/Automobile Engg. VI Sem		
S.No.	Subject Code	Subject Name
1	120616/190616	Refrigeration and Air-conditioning
2	190615	Automotive Transmission
3	120615	Mechanical Vibration

120616/190616: Refrigeration and Air-conditioning

List of skill based projects

1. Solar milk warmer cum cooler by vapour compression cycle refrigeration system.
2. Air purification using Electrostatic plate and coupled with Dehumidifier.
3. Air conditioning system by vehicle suspensor.
4. Heat dissipation in cars using thermo electric Refrigeration.
5. Solar Peltier Air Conditioner / Refrigerator.
6. Solar powered Electrolux Refrigeration System.
7. Water cooler cum Water Heater by using Refrigeration System.
8. Electrical Power Generation and Refrigeration by using waste heat from IC Engine.
9. Bicycle powered Refrigerator.
10. Air preheating System using condenser waste heat in Automobile.

190615: Automotive Transmission

List of skill based projects

1. Sterling Engine Helicopter.
2. EL-bow mechanism – Gearless Transmission System.
3. Miniature Shiftless Transmission.
4. Wireless Power Transmission via Solar Power Satellite.
5. Fabrication of Solar railway track crack detecting vehicle.
6. Fabrication of Automatic Vehicle Over speed controlling system for School Zone.
7. Over speed indication and Automatic accident Avoiding System for four-wheeler.
8. Button operated electro- magnetic gear shifting system for two-wheeler.
9. Highways High Speed Sensing and Automatic Speed Braking System.
10. Automatic temperature controller with cooling system for car.

120615: Mechanical Vibration

List of skill based projects

1. Pass-by Noise Reduction in Motorcycles by designing a Hybrid Muffler.
2. Shock Absorber Design for Rickshaw.
3. Mode Shapes of Cantilever beam.
4. Mode Shapes of Aeroplane Model.
5. Modal analysis of a L-Shaped Structure.
6. Vibration Analysis of Multi-storey Building.
7. Model Frequencies of Steering Wheel.
8. Design and construction of a spring loaded mass launcher.
9. Design of a Vibration Isolation System.
10. Design and construction of a small solar-powered vehicle.

Item ME12	To review and finalize the scheme and syllabi of B. Tech. IV Semester (for batch admitted in 2022-23) under the flexible curriculum along with their COs.

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DEAN (ACADEMICS) 03/12/2024
M.I.T.S

Scheme of Evaluation

B. Tech IV Semester (Mechanical Engineering)

(for batch admitted in academic session 2022-23)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam
				Theory Slot				Practical Slot									
				End Term Evaluation		Continuous Evaluation		End Sem. Exam	Continuous Evaluation			L	T	P			
				End Sem. Exam	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project							
1.	2100028	DC	Engineering Mathematics- III	50	10	20	20	-	-	-	100	3	1	-	4	Blended	PP
2.	2120411	DC	Industrial Engineering	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
3.	2120412	DC	Design of Machine Elements	50	10	20	20	60	20	20	200	2	1	2	4	Blended	AO
4.	2120413	DC	Theory of Machines –II	50	10	20	20	60	20	20	200	2	1	2	4	Blended	AO
5.	2120414	MC	Cyber Security	50	10	20	20	-	-	-	100	2	-	-	2	Blended	MCQ
6.	2120415	DLC	Production Lab	-	-	-	-	60	20	20	100	-	-	4	2	Offline	SO
7.	200xxx	CLC	Novel Engaging Course (Informal Learning)	-	-	-		50	-	-	50	-	-	2	1	Interactive	SO
Total				250	50	100	100	230	60	60	850	11	4	10	20	-	-
8.	3000002	Natural Sciences & Skills	Engineering Chemistry	50	10	20	20	30	10	10	150	1	-	2	Grade	Blended	MCQ
9.	1000001	MAC	Indian Constitution and Traditional Knowledge	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ
Summer Internship Project – II (Institute Level) (Qualifier): Minimum two-week duration: Evaluation in V Semester.																	

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

Natural Sciences& Skills: Engineering Physics / Engineering Chemistry / Environmental Science/ Language.

Credits of Natural Sciences & Skills will be added in the VI Semester.

MCQ: Multiple Choice Question AO: Assignment + Oral OB: Open Book PP: Pen Paper SO: Submission + Oral

Mode of Teaching				Mode of Examination				Total Credits
Theory			Lab	Theory			Lab	
Offline	Online	Blended	Offline	PP	AO	MCQ	SO	
0	0	17	3	11	4	2	3	20
0	0	85%	15%	55%	20%	10%	15%	Credits %

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Scheme of Evaluation

B. Tech IV Semester (Automobile Engineering)

(P31012024)

DEAN (ACADEMICS)

MITS GWALIOR

(for batch admitted in academic session 2022-23)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam
				Theory Slot				Practical Slot									
				End Term Evaluation		Continuous Evaluation		End Sem. Exam	Continuous Evaluation			L	T	P			
				End Sem. Exam	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project							
1.	2100028	DC	Engineering Mathematics- III	50	10	20	20	-	-	-	100	3	1	-	4	Blended	PP
2.	2190411	DC	Industrial Engineering	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
3.	2190412	DC	Design of Machine Elements	50	10	20	20	60	20	20	200	2	1	2	4	Blended	AO
4.	2190413	DC	Theory of Machines –I	50	10	20	20	60	20	20	200	2	1	2	4	Blended	AO
5.	2190414	MC	Cyber Security	50	10	20	20	-	-	-	100	2	-	-	2	Blended	MCQ
6.	2190415	DLC	Production Lab	-	-	-	-	60	20	20	100	-	-	4	2	Offline	SO
7.	200xxx	CLC	Novel Engaging Course (Informal Learning)	-	-	-		50	-	-	50	-	-	2	1	Interactive	SO
Total				250	50	100	100	230	60	60	850	11	4	10	20	-	-
8.	3000002	Natural Sciences & Skills	Engineering Chemistry	50	10	20	20	30	10	10	150	1	-	2	Grade	Blended	MCQ
9.	1000001	MAC	Indian Constitution and Traditional Knowledge	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ
Summer Internship Project – II (Institute Level) (Qualifier): Minimum two-week duration: Evaluation in V Semester.																	

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

Natural Sciences& Skills: Engineering Physics / Engineering Chemistry / Environmental Science/ Language

Credits of Natural Sciences & Skills will be added in the VI Semester.

MCQ: Multiple Choice Question AO: Assignment + Oral OB: Open Book PP: Pen Paper SO: Submission + Oral

Mode of Teaching				Mode of Examination				Total Credits
Theory			Lab	Theory			Lab	
Offline	Online	Blended	Offline	PP	AO	MCQ	SO	
0	0	17	3	11	4	2	3	20
0	0	85%	15%	55%	20%	10%	15%	Credits %

For batches admitted in Academic Session 2022-23

2190411/2120411: Industrial Engineering

Category	Title	Code	Credits: 3			Theory Paper
			L	T	P	
Departmental Core-DC	Industrial Engineering	2190411/2120411	2	1	-	Max.Marks-50 Duration-2hrs.

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

Syllabus

UNIT-I

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

Production Planning and Control: Needs of Production Planning and control, objectives of PPC, Principles of PPC, Functioning of PPC, Factor determining the PPC and Elements of PPC.

UNIT-II

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

Aggregate Planning: Introduction to Aggregate Planning, Factors affecting aggregate planning, objectives and aggregate planning strategies, aggregate planning methods.

UNIT-III

Inventory Control: Meaning and types of inventories, objectives, and functions, need and classifications-codification and standardization, inventory control terminology, inventory cost relationship, deterministic and probabilistic inventory models, quantity discount, Probabilistic inventory management, economic ordering quantity procurement cost, carrying charges, lead-time, reorder point, selective control of inventory

UNIT-IV

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

Unit-V

Production Scheduling and control: Production control outline, Gantt chart, n jobs and 2 machine problems, n jobs and 3 machine problems, Johnson's algorithm, scheduling strategies, concept of single machine scheduling, shortest Processing time rule, earliest due date, Model to Minimize total tardiness, branch, and bound technique to minimize tardiness. Floor shop scheduling, Job shop scheduling

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

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

1. Apply the concept of productivity measurement and production systems
2. Compute the demand forecasting in a dynamic market environment
3. Calculate economic order quantity (EOQ) for a given set of inventory parameters
4. Apply the principles of material requirements planning (MRP)
5. Evaluate the efficiency of different scheduling strategies in meeting production deadlines

Text Books:

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

Reference Books:

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

List of Open Source Software/learning website:

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

For batches admitted in Academic Session 2022-23

2120412/2190412: Design of Machine Elements

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Design of Machine Elements	2120412/ 2190412	2	1	2	Max.Marks-50 Duration-2 hrs.

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

Course Pre-Requisites:
Mathematics-I
Mechanics of Materials

Course Objectives: To make the students:
1. Able 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 Introduction: Design process, Factor of safety, design standards and units, Material selection in Mechanical Design, surface finish symbols, Surface Roughness, limit, fit, and tolerance, Gauge design, Tolerance analysis in manufacturing and assembly, Design for Manufacturability, Comparison between conventional design process and modern design process

Unit-II Bolted, Riveted and Welded joints: Definition, Nomenclatures, Classifications, Applications, Methods of joining, Loadings & Failures, Design procedures, Eccentric loading problems.

Unit-III Cotter and Knuckle joints: Definitions, Nomenclature, Classifications, Comparison between keys and cotters, Design of Socket and spigot cotter joint, Sleeve type Cotter joint, Cotter with Gib, Knuckle Joint, Suspension link, Pin joint, Adjustable joint, Turn-buckle.

Unit-IV Shafts, Keys and Couplings: Definitions, Classifications and Applications. Design under various loads and cases.

Unit-V Theories of Failures: Maximum normal stress and shear stress theory, maximum normal strain and shear strain theory, maximum distortion energy theory. Applications of theories to different material. Introduction to 2D, 3D modules and tools, Fundamentals and applications of CAD/CAM. Concept of computer aided drafting and Machine drawing.

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

1. Design a mechanical component considering tolerances and fits.
2. Design a welded joint considering specific applications and loading conditions

3. Design a cotter joint for a given mechanical application.
4. Design a coupling for a given mechanical system.
5. Design a simple 2D or 3D module using CAD tools.

Text &Reference Books

1. Mechanical Engineering Design byShigley JE et al; TMH
2. Machine Design byMubeen
3. Design of Machine elementsbyBhandari VB; TMH
4. Text Book of Machine Drawing byJohn KC; PHI Learning
5. Engineering design – George Dieter, MGH, New York.
6. Machine Drawing byBhat, ND; Charotar.
7. Machine Drawing byNarayana and Reddy; New age, Delhi.
8. Design data book by PSG
9. Fundamental of Engg Drawing Interactive Graphics byLuzzader WJ, Duff JM; PHI.
10. Mechanical design data book by Mahadevan and Reddy's;CBS

NPTEL Link for Design of Machine Elements

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

List of Experiments

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

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

CO1 **Design** and analysis the different part of an I.C Engine like Piston, cylinder, connecting rod , crank shafts , flywheel.

CO2 **Compare** the materials used in designing the automobile engine parts.

CO3 ***Use*** *the software like AUTO CAD , CATIA , PRO/E, SOLID WORKS.*

CO4 **Select** the spring for a proper application also can select the proper material of spring.

CO5 **Design** the different types of gear like spur gear, helical gear , worm gear , bevel gear and also able to know their practical applications.

CO6 **Create** a gear box for modern Automotive vehicles and can use this for the benefits of society.

For batches admitted in Academic Session 2022-23

2120413: Theory of Machines-II

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Theory of Machines-II	2120413/ 120520/	2	1	2	Max.Marks-35 Duration-2 hrs.

Course Pre-Requisite:
Engineering Graphics
Mechanics of Materials
Theory of Machines

Course Objectives: To make the students:

1. Understand the basics of synthesis of simple mechanisms.
2. Apply fundamental of mechanics to machines elements which include gear, gear train, cams etc..
3. Develop an ability to design a system, component, or process to meet desired needs within realistic constraints.

Syllabus

Unit- I Gears: Classification, Terminology, Law of gearing, Forms of teeth, Tooth profile, Cycloidal and Involute tooth forms, path of contact, teeth in contact, Interference. Spur, Helical, Spiral, Worm and Bevel gears.

Unit- II Gear Trains: Simple, Compound, Reverted and Epicyclic gear trains, Velocity Ratio. Various applications of gear trains - Motor car gear box, Differential mechanism, cyclometer mechanism etc.

Unit-III Balancing: Introduction, Balancing of rotating and reciprocating masses, Locomotive balancing, Balancing of multi cylinder in line engines, Balancing of radial engines, Direct and reverse crank method of balancing.

Unit-IV Cams and Cam Dynamics: Introduction, Classification of cams and followers, Terminology, Displacement, Velocity and acceleration diagrams for different follower motions, Synthesis of cam profiles. Cams with specified contours, Cam dynamics.

Unit-V Synthesis of Linkages: Introduction, Types, Number and Dimensional synthesis, Function Generation, Chebychev's spacing of accuracy points, Synthesis with three accuracy points of 4-bar and slider-crank mechanisms, Synthesis of crank rocker mechanisms with optimum transmission angle, Path generation.

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

1. Create a gear system for a particular machinery application, considering factors like load and speed
2. Design a customized gear train for a given mechanical system
3. Develop a balanced configuration for a radial engine, considering optimal performance and reduced vibrations
4. Construct a cam system with specified contours
5. Propose a linkage with an optimal transmission angle for improved efficiency and reduced wear.

Text & References Books:

1. Design of Machinery by Robert L.Norton; TATA McGraw Hill.
2. Theory of Machines by S S Rattan; Tata McGraw Hill.
3. Theory of Machines by R S Khurmi; J K Gupta; S. Chand.
4. Mechanism & Machine Theory by Ashok G. Ambekar; PHI (Prentice-Hall India).
5. Theory of Machines by Sadhu Singh; Pearson Education.
6. Theory of Machines and Mechanisms by P L Ballaney; Khanna Publishers.
7. Theory of Machines by R K Bansal; Laxmi Publications.

NPTEL Link for Theory of Machines-II

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

List of experiments

1. Study of various types of gears.
2. Study of various types of gear trains.
3. Balancing of rotating masses.
4. Balancing of reciprocating masses.
5. Study of kinematic synthesis of mechanisms.
6. Study of cams and followers.
7. To draw cam profile, velocity and acceleration diagrams of a given cam-follower mechanism.
8. Draw the profile of various cams with different types of followers.
9. Plot the follower displacement vs angle of cam rotation curves for changing compression spring, follower weights and cam speed.
10. Calculate the epicyclic gear ratio, input torque, holding torque and output torque.

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

CO1 **Identify** the kinematic chain and mobility, and perform the kinematic analysis of a given mechanism.
CO2 **Analyze** various motion transmission elements like gears, gear trains, cams, belt drive and rope drive
CO3 **Determine** the degrees-of-freedom (mobility) of a mechanism
CO4 **Apply** the fundamental principles of statics and dynamics to machinery.
CO5 **Evaluate** the dynamic forces for various machines.
CO6 **Analyze** the fundamentals of machines for desired kinematic or dynamic performance.

For batches admitted in Academic Session 2022-23

2190413: Theory of Machines-I

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Theory of Machines-I	2190413	2	1	2	Max.Marks-35 Duration-2 hrs.

Pre-Requisite:

Engineering Graphics, Mechanics of Material

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:

1. Create a mechanism that meets specific requirements for degree of freedom.
2. Construct a mechanism that achieves a desired instantaneous center in its motion
3. Develop a flywheel design that meets requirements for a given reciprocating engine.
4. Modify a braking system suitable for a particular type of vehicle.
5. Design a gyrostabilizer for a specific application.

Text Books:

1. Theory of Machines **by** Rattan, SS., TMH
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, Thomos, Pearson/ CBS PUB Delhi
7. Mechanism and Machine Theory **by** Rao, JS and Dukkipati, 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 Theory of Machines-I

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

List of experiments

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 clutch.
8. Study of various types of brakes.
9. Study of various types of dynamometer.
10. Use virtual lab for any two experiments.
11. Determine the gyroscopic effect of a rotating disc.
12. Determine the Coriolli's component of acceleration.
13. Find the total slip, creep, velocity ratio and coefficient of friction between belt and pulley system.
14. Measure the percentage slip at fixed belt tension by varying load on brake drum

Course Outcomes:

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

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

For batches admitted in Academic Session 2022-23

Production Lab

Category	Title	Code	Credit-2			Practical Slot
			L	T	P	
Departmental Lab Core-DLC	Production Lab	2120415/2190415	-	-	4	Max.Marks-60 Min.Marks-19

Course Objective:

1. To demonstrate the fundamentals of machining processes and machine tools.
2. To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
3. To apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, etc.

List of Experiments:

1. Step Turning and Taper Turning on Lathe.
2. Threads Cutting and Knurling on Lathe.
3. Machining Flat Surface using Shaper Machine.
4. Manufacturing of Spur Gear using Milling Machine.
5. Making Internal Splines using Slotting Machine.
6. Hole on work piece through Drilling.
7. Grinding of Single Point Cutting Tool
8. Slot / Groove cutting using shaping machine.
9. Performance on mold making of Simple component.
10. Performance on pattern making of Simple component.
11. Performance on Metal Casting of Simple component.
12. Performance on Welding of simple work piece (Example Arc Welding)
13. Performance on Sheet Metal work of Simple component.
14. Performance on hot forging of Simple component
15. All Students must complete one skill based project assigned by faculty

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

CO1 Demonstrate the failure occurs during manufacturing process.

CO2 Apply the theory of metal cutting in experiments.

CO3 Perform step, taper turning, knurling and threading.

CO4 Produce stepped surface using shaper and keyway using milling machine.

CO5 Demonstrate knowledge of different machine tools used in machine shop.

CO6 Evaluate the chip thickness ratio, shear angle and material removal rate.

Item ME13	To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in Batch IV semester **(for batch admitted in 2022-23).**

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Mechanical/Automobile Engg.		
S.No.	Subject Code	Subject Name
1	2120412/2190412	Design of Machine Elements
2	2120413/2190413	Theory of Machines-I/II
3	2120415/2190415	Production Lab

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2120412/2190412: Design of Machine Elements

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Design of Machine Elements	2120412/2190412	2	1	2	Max.Marks-50 Duration-2 hrs.

List of Experiments

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

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

CO1 **Design** and analysis the different part of an I.C Engine like Piston, cylinder, connecting rod , crank shafts , flywheel.

CO2 **Compare** the materials used in designing the automobile engine parts.

CO3 **Use** the software like AUTO CAD , CATIA , PRO/E, SOLID WORKS.

CO4 **Select** the spring for a proper application also can select the proper material of spring.

CO5 **Design** the different types of gear like spur gear, helical gear , worm gear , bevel gear and also able to know their practical applications.

CO6 **Create** a gear box for modern Automotive vehicles and can use this for the benefits of society.

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2120413/2190413: Theory of Machines-I/II

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Theory of Machines-I/II	2120413/2190413	2	1	2	Max.Marks-50 Duration-2 hrs.

List of experiments

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 clutch.
8. Study of various types of brakes.
9. Study of various types of dynamometer.
10. Use virtual lab for any two experiments.
11. Determine the gyroscopic effect of a rotating disc.
12. Determine the Coriolli's component of acceleration.
13. Find the total slip, creep, velocity ratio and coefficient of friction between belt and pulley system.
14. Measure the percentage slip at fixed belt tension by varying load on brake drum

Course Outcomes:

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

CO1: **Design** and **analyze** mechanism required for the specified type of motion.
CO2: **Construct** different types of cam profile for a given data.
CO3: **Draw** inversions and determine velocity and acceleration of different mechanisms.
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.

2120415/2190415: Production Lab

Category	Title	Code	Credit-2			Practical Slot
			L	T	P	
Departmental Lab Core-DLC	Production Lab	2120415/2190415	-	-	4	Max Marks-60 Min Marks-19

List of Experiments:

1. Step Turning and Taper Turning on Lathe.
2. Threads Cutting and Knurling on Lathe.
3. Machining Flat Surface using Shaper Machine.
4. Manufacturing of Spur Gear using Milling Machine.
5. Making Internal Splines using Slotting Machine.
6. Hole on work piece through Drilling.
7. Grinding of Single Point Cutting Tool
8. Slot / Groove cutting using shaping machine.
9. Performance on mold making of Simple component.
10. Performance on pattern making of Simple component.
11. Performance on Metal Casting of Simple component.
12. Performance on Welding of simple work piece (Example Arc Welding)
13. Performance on Sheet Metal work of Simple component.
14. Performance on hot forging of Simple component

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

CO1 **Define** the different conventional method of material removal and function of different parts.
CO2 **Apply** the theory of metal cutting in experiments.
CO3 **Perform** step, taper turning, knurling and threading.
CO4 **Produce** stepped surface using shaper and keyway using milling machine.
CO5 **Demonstrate** knowledge of different machine tools used in machine shop
CO6 **Evaluate** the chip thickness ratio, shear angle and material removal rate.

Item ME14	To review and finalize the suggestive list of projects which can be offered under the 'Skill based mini-project' category in various laboratory components based courses to be offered in B. Tech IV Semester (for the batch admitted in 2022-23).

]

Mechanical/Automobile Engg.		
S.No.	**Subject Code**	**Subject Name**
1	**2120412/2190412**	Design of Machine Elements
2	**2120413/2190413**	Theory of Machines-I/II
3	**2120415/2190415**	Production Lab

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Academic session 2022-23 admitted

2120412/2190412: Design of Machine Elements

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Design of Machine Elements	2120412/2190412	2	1	2	Max.Marks-50 Duration-2 hrs.

Skill Based Project

1. FEA of lap joint based on various geometrical parameters to study the behaviour of weld strength
2. Simulation of welding to study residual stress and distortions
3. Analysis of composite multi leaf spring using ANSYS 2020 R1
4. Heat Transfer analysis for different materials of ball bearing using ANSYS 2020 R1
5. Numerical analysis of Modified tooth in Spur Gear for increasing the performance by reducing the assembly errors and gear slippage in the axial direction during dynamic loading.

2120413/2190413: Theory of Machines-I/II

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Theory of Machines-I/II	2120413/2190413	2	1	2	Max.Marks-50 Duration-2 hrs.

Skill Based Project

1. Investigation of gyroscopic couple for self-balancing vehicle.
2. Understanding of balancing and alignment
3. Development of various toy mechanism
4. Understanding of Gear based quick return mechanism.
5. Investigation and understanding of geared cycle.
6. Understanding of gear mechanism used in watch.
7. Design of easy (make/use) cycle.
8. Working model of epicyclical gear train.
9. Investigation and understanding of sports cycle.

2120415/2190415: Production Lab

Category	Title	Code	Credit-2			Practical Slot
			L	T	P	
Departmental Lab Core-DLC	Production Lab	2120415/2190415	-	-	4	Max.Marks-60 Min.Marks-19

Skill Based Project

1. Design and simulation of venting passages to prevent blow hole defect.
2. Development of low-cost experimental setup to study metal flow through gating channels.
3. Preparation of different types of patterns by using wax/wood material.
4. Fabrication of working model of brazing and soldering setup.
5. Preparation of educational wooden model of different types of furnaces.
6. Working model of the coining machine and prepare the die for the coining.
7. Fabrication of plastic injection molding machine by using extrusion principle.
8. Preparation of educational model of powder metallurgy setup.
9. Demonstration model of MIG and TIG setup.
10. Battery operated working model of lathe machine.
11. Working setup of Arduino CNC plotter.
12. Working model of foot operated hammering machine for forging purpose.

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21/12/23

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Scheme of Evaluation

B. Tech IV Semester (Mechanical Engineering)

04/01/24 (ACADEMICS)

M.I.T.S

(for batch admitted in academic session 2023-24)

S.No	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam	Duration of Exam.
				Theory Slot				Practical Slot										
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation			L	T	P				
				End Sem. Exam	$proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project								
1.	3120221	DC	Material Science	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 Hrs
2.	3120222	DC	Manufacturing Processes	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 Hrs
3	3120223	DC	Engineering Thermodynamics	50	10	20	20	-	-	-	100	3	1	-	4	Blended	PP	2 Hrs
4	3100014	ESC	Engineering Graphics	50	10	20	20	-	-	-	100	2	1	-	3	Offline	AO	2 Hrs
5.	3160222	ESC	Python Programming	50	10	20	20	40	30	30	200	2	1	2	4	Blended	AO	2 Hrs
6	3100024	ESC	Manufacturing Practices	-	-	-	-	40	30	30	100	-	-	2	1	Offline	SO	-
7	3100018	ESC	Engineering Graphics Lab	-	-	-	-	40	30	30	100	-	-	2	1	Offline	SO	-
Total				250	50	100	100	120	90	90	800	11	05	06	19	-	-	-
8.	3000004	Natural Sciences & Skills	Language	50	10	20	20	30	10	10	150	1	-	2	GRADE	Blended	MCQ	1.5 Hrs

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

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

Natural Sciences & Skills: Engineering Physics / Engineering Chemistry / Environmental Engineering / Language , Credits of Natural Sciences & Skills will be added in the VI Semester

MCQ: Multiple Choice Question AO: Assignment + Oral OB: Open Book PP: Pen Paper SO: Submission + Oral

Mode of Teaching				Mode of Examination				Total Credits
Theory			Lab	Theory			Lab	
Offline	Online	Blended	Offline	PP	AO	MCQ	SO	19
3	-	14	2	10	7	0	2	Credits*
15%	-	73.68	10.5	52.6	36.8	0	10.5	

ME//CM

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Department of Mechanical Engineering

For batches admitted in Acedemic Session 2023-24

Basic Mechanical Engineering

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Engineering Science-ESC	Basic Mechanical Engineering	3100021/2100021	2	1	-	Max.Marks-50 Duration-2 hrs.

Course Objectives: To make the students:

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

Syllabus

UNIT-I:

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

UNIT-II:

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

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

1. Determine the yield strength and modulus of elasticity from a given stress-strain diagram.
2. Design a measurement setup for a specific engineering task.
3. Analyze the working principles of pumps, compressors, turbines, and positive displacement machines.

4.Calculate the efficiency of different boilers.

5.Evaluate the practicality and limitations of different reciprocating machine cycles.

Reference Books:

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

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Department of Mechanical Engineering

For batches admitted in Academic Session 2023-24

Basic Mechanical Engineering Lab

Category	Title	Code	Credit-1			Practical End Sem
			L	T	P	
Engineering Science-ESC	Basic Mechanical Engineering Lab	3120026	-	-	2	Max.Marks-60 Min.Marks-19

List of Experiments:

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

Skill Based Projects:

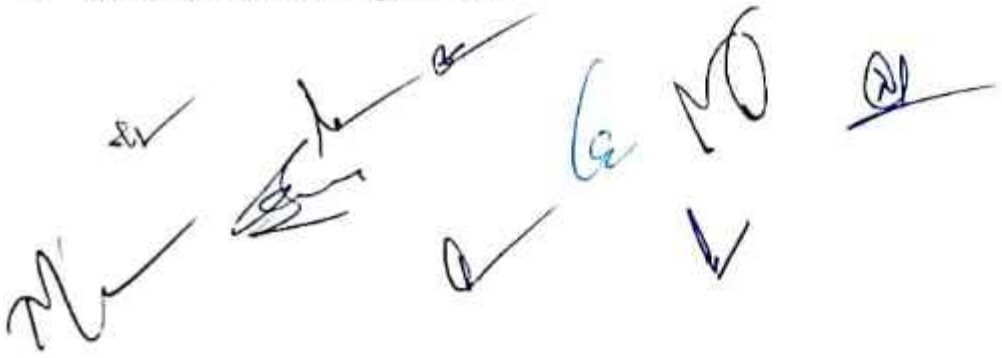
1. Measurement and calibration using slip gauges
2. Performing energy audit using stroboscope and lux meter
3. Make a Free energy Steam Engine at home
4. Make an Air Compressor at home
5. Mini Bench Tapping machine project
6. Make a Robotic Arm
7. Tornado in a bottle
8. Make a Hydraulic Lift
9. Thermal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

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

1. Perform tests on testing machines for mechanical properties.
2. Demonstrate the functionality of different boilers and I.C. engines.
3. Operate lathe, milling, shaper machine to turn a work-piece to specified dimensions.
4. Propose measuring instruments for a given object.

Reference Books:

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



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Department of Mechanical Engineering

For batches admitted in Academic Session 2023-24

3100014: Engineering Graphics

Category	Title	Code	Credit-3			Theory Slot
			L	T	P	
Engineering Science-ESC	Engineering Graphics	3100014/2100014	2	1	-	Max.Marks-35 Duration-2hrs.

Course Objective:

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

Syllabus:

Unit - 1

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

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

Unit - 2

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

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

Unit - 3

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

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

Unit - 4

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

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

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

Unit - 5

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

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

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

1. Create proficiency in drawing of scale, curves, spirals and involutes.
2. Determine the positions of points in various projections, applying the principles of quadrant systems and traces of lines

3. Apply principle of projections in planes and solids.
4. Apply sectioning techniques to analyze and interpret the internal features of solids
5. Exhibit competence in generating isometric projections using Auto CAD.

Text books:

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

NPTEL Link for Engineering Graphics:

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

For batches admitted in Academic Session 2023-24

3100018: Engineering Graphics Lab

Category	Title	Code	Credit-1			Practical End Sem
			L	T	P	
ESC	Engineering Graphics Lab	3100018	-	-	2	Max.Marks-60 Min.Marks-19

Laboratory Work

List of Experiments:

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

Skill Based Projects:

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

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

1. Create proficiency in drawing of scale, curves, spirals and involutes.
2. Determine the positions of points in various projections, applying the principles of quadrant systems and traces of lines
3. Apply principle of projections in planes and solids.
4. Apply sectioning techniques to analyze and interpret the internal features of solids
5. Exhibit competence in generating isometric projections using Auto CAD.

Text books:

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

For batches admitted in Academic Session 2023-24

3100024: Manufacturing Practices

Category	Title	Code	Credit-I			Practical End Sem
			L	T	P	
Engineering Science-ESC	Manufacturing Practices	3100024	-	-	2	Max.Marks-60 Min.Marks-19

Course Objectives:

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

Syllabus

UNIT-I
Introduction: Manufacturing Processes and its Classification, Casting, Machining, Plastic deformation and Metal forming, Joining Processes, Heat treatment process, Assembly process.
Black Smithy Shop
Use of various smithy tools. Forging operations; Upsetting, Drawing down, Fullering, swaging, Cutting down, Forge welding, Punching and drafting.
Suggested Jobs: Forging of chisel, forging of Screw Driver.

UNIT-II Carpentry Shop
Timber: Type, Qualities of timber disease, Timber grains, Structure of timber, Timber seasoning, Timber preservation. Wood Working Tools: Wood Working Machinery, joints and joinery, various operations of planning using various carpentry planes sawing & marking of various carpentry joints.
Suggested Jobs: Name Plate, Any of the carpentry joint like mortise or tennon Joint.

UNIT-III Fitting Shop:
Study and use of measuring instruments, Engineer steel rule, Surface gauges caliper, Height gauges, feeler gauges, Micrometer. Different types of files, File cuts, File grades, Use of surface plate, Surface gauges drilling tapping Fitting Operations: Chipping filling, Drilling and Tapping.
Suggested Jobs: Preparation of job piece by making use of filing, sawing and chipping, drilling and tapping operation.

UNIT-IV Foundry:
Pattern Making: Study of pattern materials, pattern allowances and types of patterns. Core box and core print, Use and care of tool used for making wooden patterns.
Moulding: Properties of good mould& Core sand, Composition of Green, Dry and Loam sand. Methods used to prepare simple green and bench and pit mould dry sand bench mould using single piece and split patterns.

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

precautions.

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

1. Identify the tools used in foundry, welding, sheet metal work, carpentry and fitting shop
2. Categorize the Manufacturing Processes used in engineering applications
3. Examine the materials used in manufacturing process
4. Demonstrate the failure occurs during manufacturing process

Text & References Books:

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

NPTEL Link for Manufacturing Practices

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

Laboratory Work:

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

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Department of Mechanical Engineering

For batches admitted in Academic Session 2023-24

3120221: Material Science

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Departmental Core-DC	Material Science	3120221	2	1		Max.Marks-50 Duration-2hrs.

Course Objectives: To make the students to understand:

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

Syllabus

Unit-I Structure of materials

Fundamentals of crystal structures and crystal system, crystallographic planes and directions, linear and planar density, single crystal, polycrystalline material and non-crystalline materials, Homogeneous and heterogeneous solidifications, Crystal imperfections: point, line, surface and volume defects.

Unit-II Material testing and mechanical properties

Mechanical properties in static tensile, compression and bending tests, Hardness: Rockwell, Brinell, Vicker's, Impact toughness and fracture toughness.

Role of dislocations in plastic deformation, slip and twinning processes. Mechanism of ductile and brittle fracture. Fatigue: Cyclic stresses, S-N curve, crack initiation and propagation, factors affecting fatigue life; Creep: Generalized creep behavior, stress and temperature effects.

Unit-III Engineering Materials

Ferrous (Steels and Cast irons with role of different alloying elements) and non-ferrous metals and alloys (Aluminum, Magnesium, Titanium, Copper, Nickel alloys), Nano-materials, Ceramic material, Composite material with their properties and applications, Smart materials, Bio-materials

Unit-IV Phase diagrams and phase transformation of metal alloys

Concept of phases, Gibb's phase rule, Lever-rule, binary isomorphous and eutectic phase diagrams, Eutectoid, Peritectic and Peritectoid systems, allotropy in iron, Fe-Fe_3C phase diagram; Isothermal transformation of austenite, continuous cooling transformation of austenite, Objectives of heat treatments, Annealing, Normalizing, Hardening (bulk and surface)

Unit-V Environmental consideration and some case studies

Corrosion: Introduction, types & its prevention; generalized material selection process, material selection for torsionally-stressed cylindrical shaft, Automotive valve spring, orthopedic implants, Integrated circuit and etc.

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

1. Solve the crystallographic planes and directions

2. Simulate the mechanical properties
3. Validate the properties and application of engineering materials
4. Correlate of heat treatments processes such as Annealing, Normalizing, Hardening
5. Solve the Environmental issues with the engineering materials

Text & Reference Books

1. Material Science and Engineering: An Introduction, William D. Callister, John Willey & Sons Inc., 7th edition
2. Elements of Material Science and Engineering by Lawrence, H. Vanvlackdison; Wesley.Mention the Year or the Edition and Publisher and Place of Publication
3. Material Science and Engineering by Raghvan, V; Prentice Hall of India.
4. Introduction to Engineering Materials by Agrawal, B.K; Tata McGraw Hill, N. Delhi.

NPTEL Link for Material Science

https://onlinecourses.nptel.ac.in/noc18_mm05/preview

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Department of Mechanical Engineering

For batches admitted in Academic Session 2023-24

3120222: Manufacturing Processes

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Departmental Core-DC	Manufacturing Processes	3120222	2	1	-	Max.Marks-50 Duration-2hrs.

Course Objectives: To make students:

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

Course Pre-Requisites: Manufacturing Practice

Syllabus

Unit-I Casting: Brief History, Basic principle & survey of casting processes. Sand casting, pattern materials, and allowances. Green and dry moulding, moulding methods, moulding sand properties and testing. Elements of mould and design considerations. Cores use, core materials and core making practice. Die, investment and centrifugal casting processes. Melting practice and concepts in solidification. Inspection and defects analysis.

Unit-II Forming: Elastic and plastic deformation, Concept of strain hardening. Rolling, forging, extrusion, spinning, wire and tube drawing processes, machines and equipment's, parameters and force calculations.

Unit-III Sheet Metal Working: Role of sheet metal components.Cutting mechanism. Description of cutting processes like blanking. Piercing, lancing etc. Description of forming processes like bending cup drawing, coining, embossing etc. Basic elements of presses for sheet metal working. Punch and Die clearances and die elements.

Unit-IV Welding: Principle of welding, soldering, brazing and adhesive bonding.Survey of welding and allied processes. Arc welding: power sources and consumables. MMAW, TIG& MIG processes and their parameter selection. Resistance Welding: principle and equipment. Spot, projection and Seam welding processes, Gas welding and cutting: Processes and equipment.

Unit-V Powder Metallurgy: Powder manufacturing, compaction and sintering processes. Advantages and applications of P/M. Manufacturing of Powder metallurgy components.

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

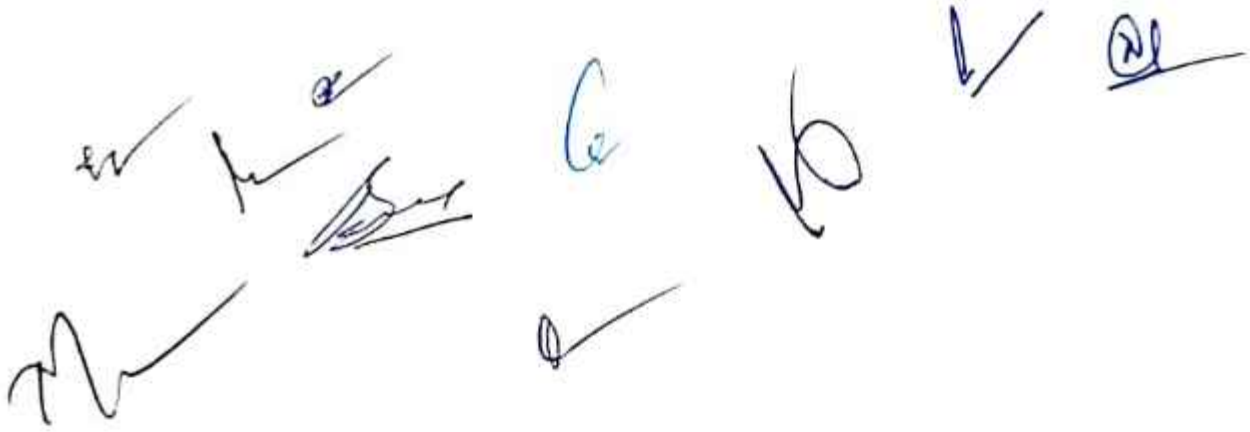
1. Assess melting practice and concepts of solidification, Inspection and defects
2. Assess machines and equipment's used in forming process
3. Assess punch, die clearances and die elements
4. Adapt suitable welding processes for engineering applications
5. Compose the engineering materials by a P/M route

Text &Reference Books

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

NPTEL Link for Manufacturing Process

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



MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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

Department of Mechanical Engineering

For batches admitted in Academic Session 2023-24

3120223: Engineering Thermodynamics

Category	Title	Code	Credit-4			Theory Paper
			L	T	P	
Departmental Core-DC	Engineering Thermodynamics	3120223/ 2120223/ 2190223	3	1	-	Max.Marks-50 Duration-2 hrs.

Course Objective: To make students able to:

1. Understand the nature and role of the various thermodynamic properties of matter.
2. Represent a thermodynamic system by a control mass or control volume and identify work and/or heat interactions between the system and surroundings.
3. Recognize the different forms of energy and restrictions imposed by the laws of thermodynamics on conversion from one form to another.

Course Prerequisites: Basic Mechanical Engineering

Syllabus

Unit–I Basic Concepts: Thermodynamics, Property, Equilibrium, State, Process, Cycle, Zeroth law of thermodynamics, Statement and significance, Concept of an Ideal gas, Gas Laws, Avogadro's Hypothesis, Heat and work transfer. First law of thermodynamics –Statement of first law of thermodynamics, first law applied to closed system undergoing a cycle, Process analysis of closed system flow process, Flow energy, Steady flow process analysis of closed system processes, Limitations of first law of thermodynamics.

Unit –II Properties of pure substances: - P-V-T surfaces, h-s, T-S, P-V, P-h, T-V diagrams of pure substance, saturated and sub-cooled liquid, superheated vapour, quality of steam, Mollier diagram, steam table, different processes, measurement of quality of steam

Unit –III Second law of thermodynamics: Heat engine, Heat reservoir, Refrigerator, Heat pump, COP, Carnot's theorem, Carnot's cycle, Efficiency of Carnot's cycle, Statement of second law, Reversible and Irreversible processes, Consequences of Second law.

Unit –IV Availability and Irreversibility: Entropy, Entropy changes of Ideal gas, Available energy, T-S diagram, Availability and Irreversibility.

Unit- V Thermodynamics Relations: Thermodynamics relations, e.g Maxwell relations and their applications.

Air Standard Cycles: Carnot, Sterling, Ericssion, Otto, Diesel, Dual cycles and determination of their air standard efficiencies and their comparison. Brayton cycle, Atkinson cycle, PVT relationship, Mixture of ideal gases Properties of mixture of gases.

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

1. Evaluate different processes within closed systems and their implications using the First Law.
2. Interpret Mollier diagrams and steam tables to extract information about substances
3. Illustrate the implications of violating the Second Law of Thermodynamics.
4. Analyze the relationship between entropy changes and available energy in different thermodynamic systems.

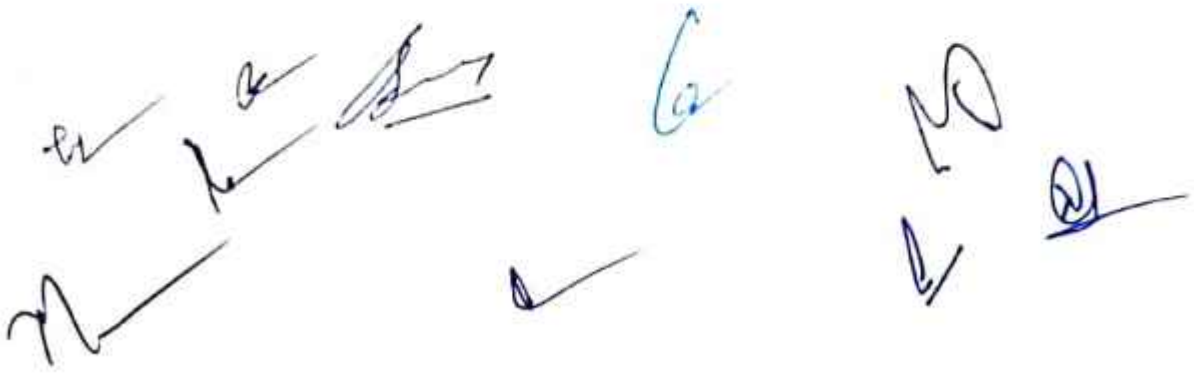
5. Assess connections between different air standard cycles and their efficiencies in practical engineering applications

Text &Reference Books:

1. Engineering thermodynamics by P.K. Nag
2. Thermal engineering by R.K. Rajput
3. Thermal engineering by P.L. Ballaney
4. P L Dhar Thermal Engineering

NPTEL Link for Engineering Thermodynamics

https://onlinecourses.nptel.ac.in/noc18_ch03/preview



Item ME16	To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in Batch II semester **(for batch admitted in 2023-24)**

Mechanical/Automobile Engg.		
S.No.	Subject Code	Subject Name
1	3100026	3100026: Basic Mechanical Engineering Lab
2	3100018	3100018: Engineering Graphics Lab
3	3100024	3100024: Manufacturing Practices

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For batches admitted in Academic Session 2023-24

3100026: Basic Mechanical Engineering Lab

Category	Title	Code	Credit-1			Practical End Sem
			L	T	P	
Engineering Science-ESC	Basic Mechanical Engineering Lab	3100026	-	-	2	Max.Marks-60 Min.Marks-19

Lists of Experiments:

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

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

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

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3100018: Engineering Graphics Lab

Category	Title	Code	Credit-1			Practical End Sem
			L	T	P	
ESC	Engineering Graphics Lab	3100018	-	-	2	Max.Marks-60 Min.Marks-19

List of Experiments:

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

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

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

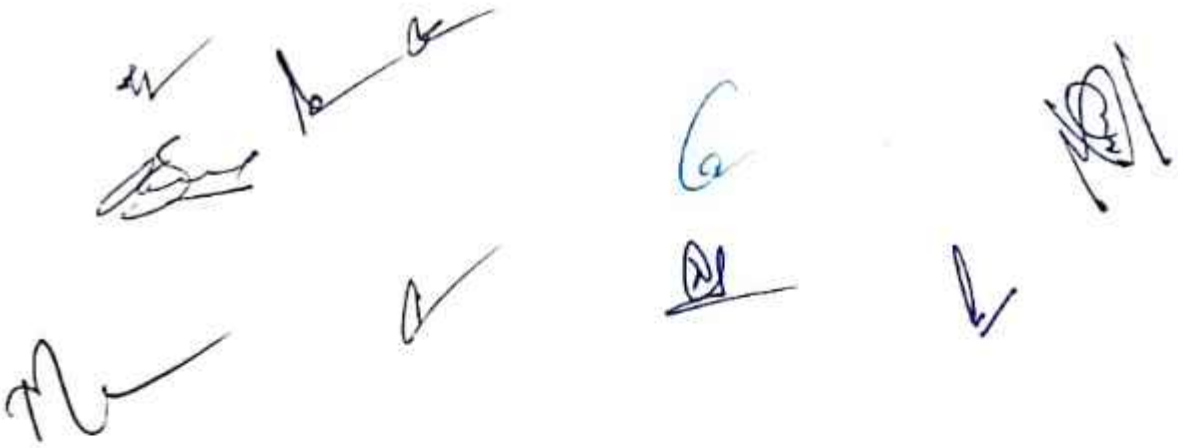
For batches admitted in Academic Session 2023-24

3100024: Manufacturing Practices

Category	Title	Code	Credit-1			Practical End Sem
			L	T	P	
Engineering Science-ESC	Manufacturing Practices	3100024	-	-	2	Max.Marks-60 Min.Marks-19

List of Experiments:

1. To draw diagram of different tools used in different shops.
2. To prepare T joint in carpentry shop.
3. To prepare flat surface of given workpiece in fitting shop.
4. To prepare mould in foundry shop.
5. To prepare casting of given material in prepared mould.
6. To prepare screw driver and ring in welding shop.



Item ME17	To review and finalize the suggestive list of projects which can be offered under the '**Skill based mini-project**' category in various laboratory components based courses to be offered in B. Tech II Semester ***(for the batch admitted in 2023-24)***.

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Mechanical/Automobile Engg.		
S.No.	Subject Code	Subject Name
1	3100026	3100026: Basic Mechanical Engineering Lab
2	3100018	3100018: Engineering Graphics Lab
3	3100024	3100024: Manufacturing Practices

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3100026: Basic Mechanical Engineering Lab

Category	Title	Code	Credit-1			Practical End Sem
			L	T	P	
Engineering Science-ESC	Basic Mechanical Engineering Lab	3100026	-	-	2	Max.Marks-60 Min.Marks-19

Skill Based Project

1.Measurement and calibration using slip gauges

2.Performing energy audit using stroboscope and lux meter

3.Make a Free energy Steam Engine at home

4.Make an Air Compressor at home

5.Mini Bench Tapping machine project

6.Make a Robotic Arm

7.Tornado in a bottle

8.Make a Hydraulic Lift

9.Thermal Expansion project

10.Make a positive displacement pump

11.Make a mini thermal power plant

12.Make a fire hydrant.

13.How an airplane wing creates lift and how wind turbine blades are spun by the wind. Make a model.

14.To make a model for measuring the pressure distribution in a convergent – divergent duct to confirm Bernoulli's equation.

15.Make a digital hydraulic bench.

16.To make a model for induced draught and natural draught

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For batches admitted in Academic Session 2023-24

3100018: Engineering Graphics Lab

Category	Title	Code	Credit-1			Practical End Sem
			L	T	P	
ESC	Engineering Graphics Lab	3100018	-	-	2	Max.Marks-60 Min.Marks-19

Skill Based Project

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

For batches admitted in Academic Session 2023-24

3100024: Manufacturing Practices

Category	Title	Code	Credit-1			Practical End Sem
			L	T	P	
Engineering Science-ESC	Manufacturing Practices	3100024	-	-	2	Max.Marks-60 Min.Marks-19

Skill Based Project

1. Design and simulation of venting passages to prevent blow hole defect.
2. Development of low-cost experimental setup to study metal flow through gating channels.
3. Preparation of different types of patterns by using wax/wood material.
4. Fabrication of working model of brazing and soldering setup.
5. Preparation of educational wooden model of different types of furnaces.
6. Working model of the coining machine and prepare the die for the coining.
7. Fabrication of plastic injection molding machine by using extrusion principle.
8. Preparation of educational model of powder metallurgy setup.
9. Demonstration model of MIG and TIG setup.
10. Battery operated working model of lathe machine.
11. Working setup of Arduino CNC plotter.
12. Working model of foot operated hammering machine for forging purpose.

Mechanical CO Attainment Jan-June 2023

4th Semester Mechanical Engg (B. Tech) Coordinator: Dr. Dinesh Kumar Rathore			Indirect CO Attainment (Through Feedback)						Direct CO Attainment (Through Exams)						Total CO Attainment (20% Indirect + 80% Direct)						Target Level	COs not attained	Action Taken
Subject Code	Subject Name	Faculty I/C	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6			
100003	Mathematics- III	Math Dept	2.55	2.05	2.50	2.10	2.00	2.35	2.55	2.29	2.30	1.95	1.93	1.93	2.57	2.24	2.40	2.09	1.97	1.99	2	CO5,CO6	More focus on the assignments
120412	Design of Machine Elements	Prof R.P Kori	2.24	2.15	2.37	2.19	2.07	2.43	2.44	2.40	2.29	1.90	1.95	1.96	2.40	2.40	2.31	1.95	1.99	2.05	2	CO4,CO5	Gives more Practical question
120413	Metal cutting and machine tools	Prof. V. Chaturvedi	2.30	2.09	1.80	2.14	2.49	2.43	2.25	2.31	2.15	2.15	2.05	1.90	2.26	2.27	2.10	2.15	2.15	1.93	2	CO5	Prior knowledge on production is missing
120414	Engineering Thermodynamics	Mr B.K Pandey	2.25	2.19	2.90	2.77	2.14	2.17	2.54	2.29	2.37	1.83	1.80	1.87	2.73	2.26	2.47	1.99	1.87	1.93	2	CO4,CO5,CO6	extra classes and taken assignment
120415	Production Lab	Dr S.K. Chourasiya	2.40	2.27	1.99	2.26	2.40	2.36	2.61	2.45	2.23	1.95	2.04	2.05	2.58	2.42	2.03	2.04	2.11	2.07	2	NIL	
100004	Cyber Security	Dr Jyoti Vimal	2.48	2.06	2.01	2.26	2.29	2.05	2.29	2.24	2.33	2.01	2.05	2.21	2.16	2.21	2.37	2.06	2.11	2.28	2	NIL	
100001	Indian Consstution and Traditional Knowledge	Humanities	2.42	2.17	2.39	2.57	2.29	2.47	2.39	2.42	2.42	2.04	1.95	1.95	2.39	2.42	2.42	2.15	2.03	2.04	2	NIL	
120412(P)	Design of Machine Elements lab	Prof R.P Kori	2.20	2.23	2.65	2.90	2.24	2.31	2.54	2.34	2.33	1.93	2.02	2.07	2.47	2.31	2.40	2.12	2.06	2.12	2	NIL	

6th Semester Mechanical Engg (B. Tech) Coordinator: Mr. V. Chaturvedi			Indirect CO Attainment (Through Feedback)						Direct CO Attainment (Through Exams)						Total CO Attainment (20% Indirect + 80						Target	COs not attained	Action Taken
Subject Code	Subject Name	Faculty I/C	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6			
120615	Mechanical Vibration	Dr. Nitin Upadhyay	2.11	2.04	2.19	2.77	2.24	2.51	2.53	2.26	2.31	2.03	1.89	1.85	2.45	2.26	2.29	2.18	1.95	1.98	2	CO5,CO6	Skill based problems are introduced
120616	Refrigeration and air conditioning	Dr M.K Gaur	2.31	2.08	2.40	2.10	2.26	2.43	2.20	2.12	2.49	2.05	1.88	1.84	2.22	2.09	2.47	2.06	1.97	1.96	2	CO5,CO6	Take extra Assignments for CO5 and CO6
120617	AI & ML	Prof Ajay Rajput	2.66	2.29	2.15	2.90	2.10	1.96	2.42	2.21	1.84	1.95	1.73	1.94	2.47	2.22	1.91	2.17	1.93	1.94	2	CO3,CO5,CO6	Practical exposure is needing to increase
120661	Fundamental of welding science and technology	Prof R.P Kori	2.11	2.24	2.19	2.77	2.24	2.51	2.74	2.05	2.90	2.53	2.26	2.31	2.61	2.29	2.76	2.58	2.26	2.35	2	NIL	
120662	Viscous fluid flow	Mr B.K Pandey	2.58	2.05	2.11	2.43	2.18	2.29	2.29	2.17	2.90	2.54	2.29	2.44	2.21	2.15	2.74	2.36	2.26	2.41	2	NIL	
120663	Properties of materials (Nature and properties of materials III)	Dr S.K. Chourasiya	2.24	2.06	2.64	2.14	2.23	2.26	2.41	2.12	1.99	2.52	2.34	2.48	2.37	2.10	2.12	2.44	2.32	2.42	2	NIL	
120618	Minor Project-II		2.19	2.17	2.90	1.80	2.29	2.26	2.05	2.07	2.56	2.22	2.07	2.01	2.09	2.09	2.63	2.14	2.03	2.05	2	NIL	
MAC	Intellectual Property Rights	Dr S.K. Chourasiya	2.29	2.18	2.90	2.77	2.14	2.17	2.60	2.05	2.37	2.34	2.26	2.37	2.46	2.26	2.45	2.53	2.26	2.33	2	NIL	
910109	Robotics	Dr Neeraj Mishra	2.19	2.05	2.63	2.26	2.15	2.15	2.36	2.29	2.36	2.55	2.26	2.29	2.33	2.23	2.45	2.51	2.23	2.26	2	NIL	
910108	Product Design	Dr Gavendra Norkey	2.42	2.26	2.31	2.21	2.33	2.42	2.90	2.21	2.18	2.30	2.24	2.29	2.52	2.19	2.29	2.24	2.26	2.19	2	NIL	
120615(P)	Mechanical Vibration lab	Dr. Nitin Upadhyay	2.20	2.17	2.36	2.45	2.46	2.32	2.32	2.42	2.19	2.52	2.06	1.93	2.30	2.37	2.22	2.49	2.13	2.00	2	NIL	
120616(P)	Refrigeration and air conditioning lab	Dr M.K Gaur	2.75	2.15	2.40	2.42	2.20	2.42	2.90	2.34	2.19	1.94	2.12	2.26	2.67	2.31	2.33	2.09	2.14	2.13	2	NIL	
120617(P)	AI & ML lab	Prof Ajay Rajput	2.20	2.26	2.90	2.68	2.67	2.23	2.16	2.16	2.19	2.12	1.56	2.10	2.19	2.16	2.33	2.23	2.08	2.12	2	NIL	

8th Semester Mechanical Engg (B. Tech) Coordinator: Dr. Surendra Chorasiya			Indirect CO Attainment (Through Feedback)						Direct CO Attainment (Through Exams)						Total CO Attainment (20% Indirect + 80						Target	COs not attained	Action Taken
Subject Code	Subject Name	Faculty I/C	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6			
120851	Quality Design and Control	Dr Sharad Aggarwal	2.49	2.28	2.90	2.42	2.27	2.32	2.48	2.23	2.40	2.11	2.14	2.21	2.65	2.20	2.50	2.17	2.15	2.23	2	NIL	
120852	Robotics: Basics and Selected Advanced Concepts	Dr. Nitin Upadhyay	2.62	2.35	2.24	2.54	2.17	2.22	2.22	2.29	2.32	2.02	2.19	2.42	2.14	2.27	2.30	2.13	2.19	2.28	2	NIL	
120855	Carbon materials and manufacturing	Dr Dinesh Rathore	2.41	2.05	2.30	2.11	2.25	2.34	2.54	2.45	2.40	2.02	2.01	2.14	2.62	2.31	2.38	2.04	2.08	2.17	2	NIL	
120801	Internship/Project		2.41	2.25	2.04	2.11	2.34	2.30	2.51	2.29	2.23	1.94	2.04	1.98	2.51	2.24	2.20	2.07	2.11	2.24	2	NIL	
120802	Professional Development		2.01	2.24	1.97	2.61	2.31	2.41	2.59	2.30	2.23	1.96	2.11	2.11	2.72	2.24	2.18	2.16	2.15	2.17	2	NIL	

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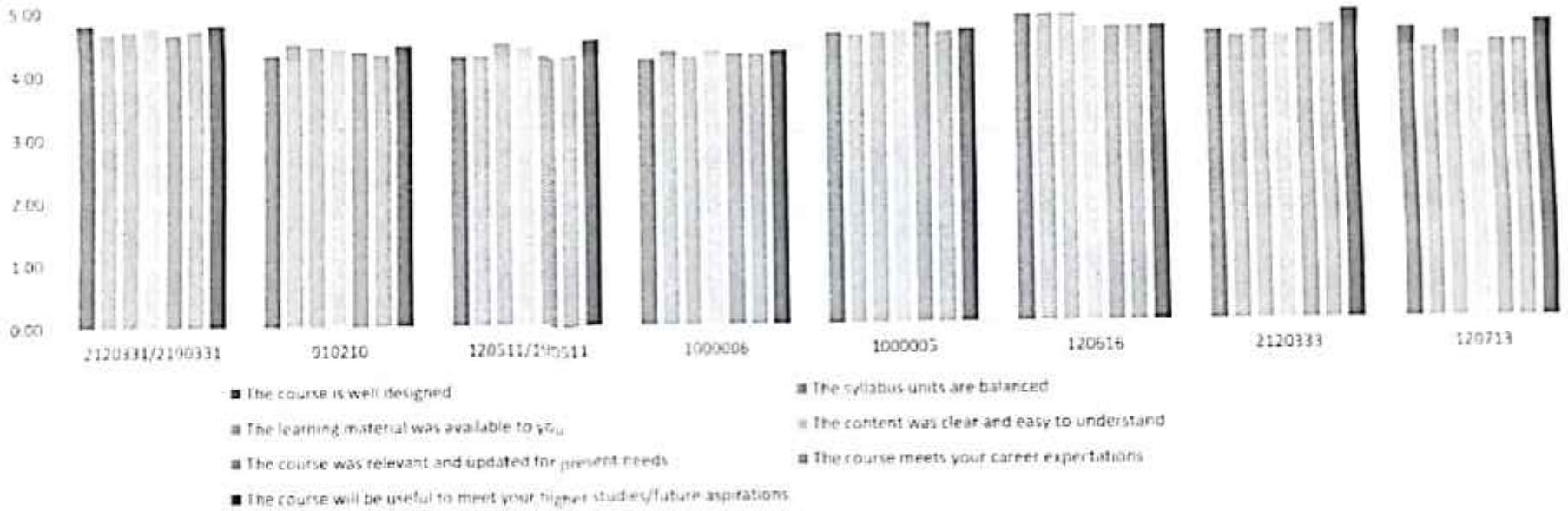
Student's Feedback on Curriculum
Action Taken on Student's Feedback

S. No.	Subject	Feedback	Action Taken
1	Disaster management	More critical problems required to be added in the syllabus	Syllabus cover all basic issues as per the credit point but it will be added.
		Foreign policy on disaster making should be the part of syllabus	Such thing covered during the lectures
2	Mechanics of materials	Advanced topic related to bending and torsion should be introduced	Advanced topic related to the mechanics of materials offered in departmental electives.
		Syllabus required modification	The syllabus is upto dated but required modification will be done in upcoming BoS
3	Heat and mass transfer	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.

Marks	CO	BL

Students feedback on course content_Curriculum



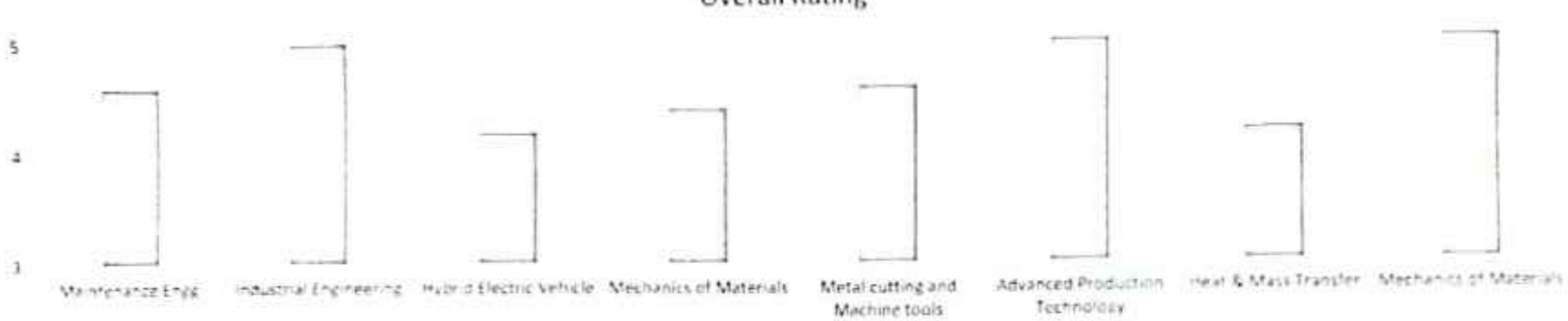
	2120331/2190331	910210	120511/190511	1000006	1000005	120616	2120333/21190333	120713
The course is well designed	4.81	4.30	4.26	4.19	4.56	4.8	4.5	4.50
The syllabus units are balanced	4.67	4.48	4.26	4.30	4.52	4.8	4.42	4.20

The learning material was available to you	4.69	4.43	4.47	4.22	4.56	4.8	4.5	4.45
The content was clear and easy to understand	4.75	4.39	4.41	4.30	4.59	4.6	4.42	4.10
The course was relevant and updated for present needs	4.64	4.35	4.26	4.26	4.70	4.6	4.5	4.30
The course meets your career expectations	4.69	4.30	4.29	4.24	4.56	4.6	4.57	4.30
The course will be useful to meet your higher studies future aspirations.	4.78	4.43	4.50	4.30	4.59	4.6	4.8	4.60

Teacher's Feedback on Curriculum

Action Taken on Teacher's Feedback

S.No.	Subject	Feedback	Action Taken
1	MOM	Syllabus is too vast and needed improvement as per current need	Syllabus has been modified and introduced some advanced testing in BoS
2	Metal cutting and machine tools	New non-destructive techniques should be learn in this sysllabus	It is subjected to the advanced machining processes subject to the NPTEL DE-Courses
3	Industrial Engineering	Numerical problem should be introduced related to industrial problems	This implementation will be done in upcoming BoS meeting
4	Maintenance engineering	Introduction to Mechanical Micro Machining	Subject is provided to the students through DE-NPTEL



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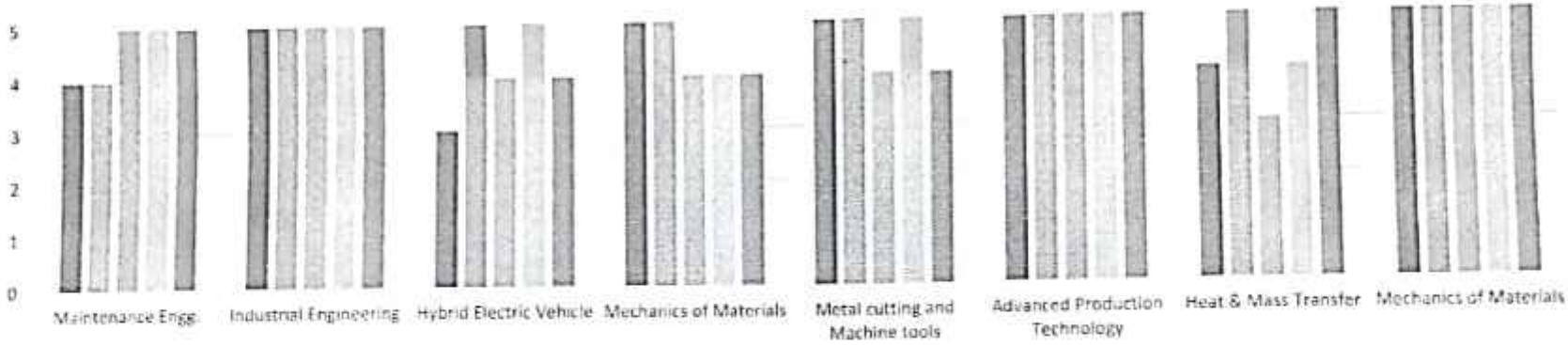
Teacher Feedback (on a scale of 1-5)



- 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.

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
Maintenance Engg.	4	4	5	5	5	4.6

	Marks	CO	BL

Industrial Engineering	5	5	5	5	5	5
Hybrid Electric Vehicle	3	5	4	5	4	4.2
Mechanics of Materials	5	5	4	4	4	4.4
Metal cutting and Machine tools	5	5	4	5	4	4.6
Advanced Production Technology	5	5	5	5	5	5
Heat & Mass Transfer	4	5	3	4	5	4.2
Mechanics of Materials	5	5	5	5	5	5

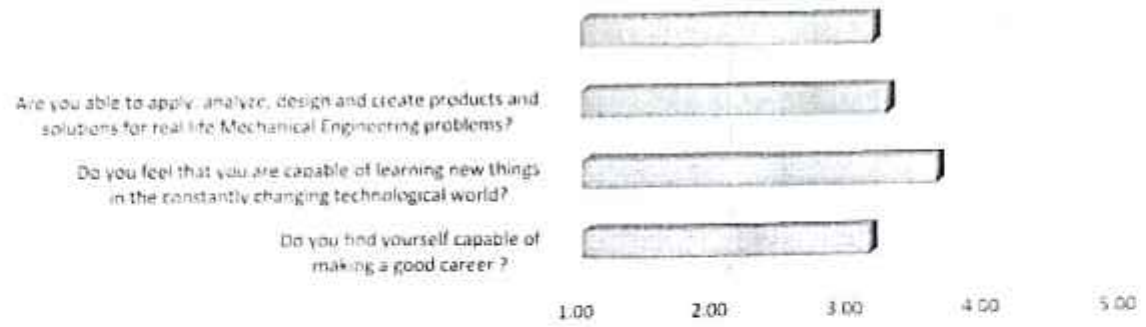
Alumni's Feedback on Curriculum

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 .

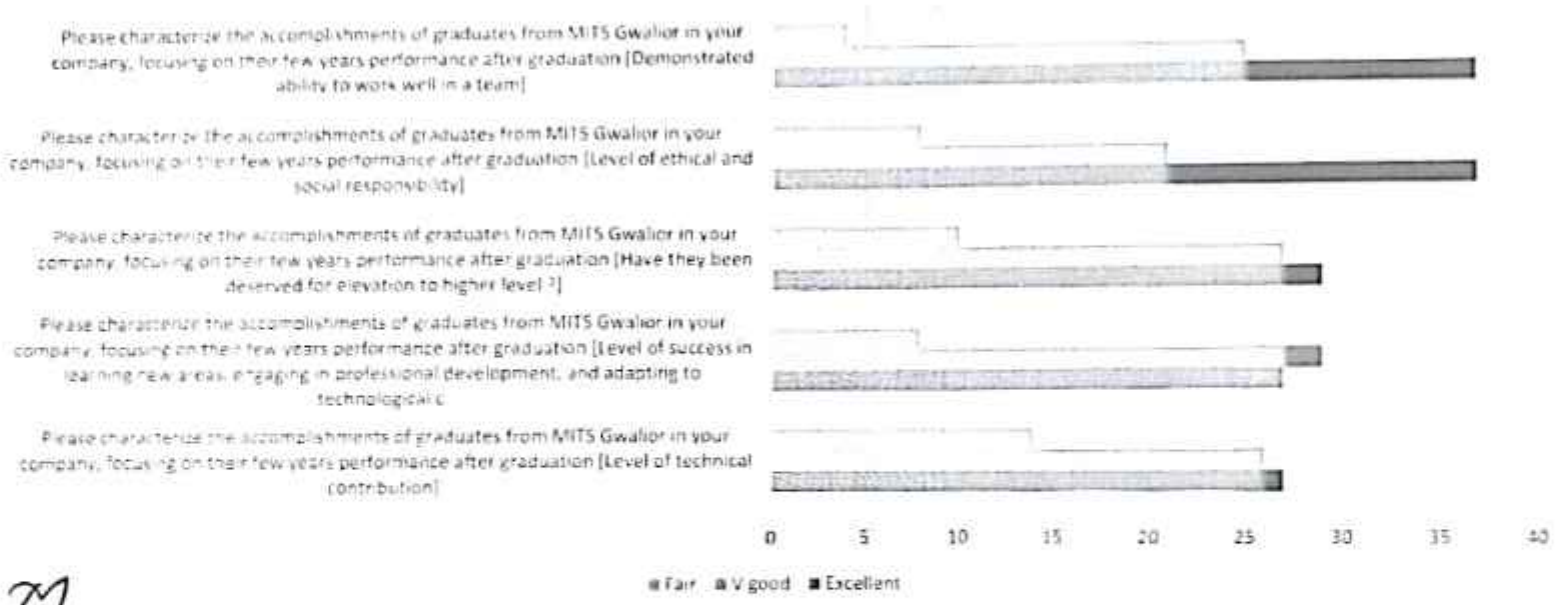
Average Feedback out of 5



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

Marks | CO | RL

Employer Feedback



Syllabus and Scheme of Master of Technology

(Production Engineering)

Department of Mechanical Engineering

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A UGC-Autonomous Institute affiliated to RGPV, Bhopal)

COURSE CONTENT: PRODUCTION ENGINEERING

Master of Technology (Production Engineering) (Semester-II)

Scheme of Examination

MIQ 03/01/2024
DEAN (ACADEMICS)
M.I.T.S
G
W.E.F JULY 2023

S. No.	Subject Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Periods per week			Total Credits
			Theory Slot			Practical Slot		MOOCs			L	T	P	
			End Sem	Mid Sem	Quiz/ Assignment	End Sem	Lab work/ sessional	Assignment	Exam					
1.	560211	Automation & Robotics	70	20	10	-	-	-	-	100	3	-	-	3
2.	560212	Production Engineering-II	70	20	10	-	-	-	-	100	3	-	-	3
3.	560213	Logistics and Supply Chain Management	70	20	10	-	-	-	-	100	3	-	-	3
4.	DE-2	#Elective-II	-	-	-	-	-	25	75	100	3	-	-	3
5.	OC-2	##Open Category Course -2 (OC-2)	~~70~~	~~20~~	~~10~~	-	-	25	75	100	3	-	-	3
6.	560220	Production Engineering Lab-II	-	-	-	90	60	-	-	150	-	-	4	4
7.	560221	$Self Learning / Presentation	-	-	-	-	100	-	-	100			2	2
		Total	~~280~~ 210	~~80~~ 60	~~10~~ 30	90	160	~~25~~ 50	~~75~~ 150	750	15	-	6	21

During labs, students have to perform practical/assignments/ minor projects related to theory subjects/theoretical concepts of respective semester using recent technologies / languages / tools etc.

#Elective-II course *will run through SWAYAM / NPTEL /MOOC based learning platform (with credit transfer facility)*

Open Category course (OC-2) will have to be opted from the pool of open courses (Student can opt from parent department and other department) and based on interdisciplinary aspects.]This course may be run through SWAYAM/NPTEL based platform *(with credit transfer facility)* and accordingly, OC-2 pool may be created from the list of SWAYAM/NPTEL courses)

$Self learning / presentation through SWAYAM / NPTEL(Registration in a course will be compulsory for students bus assessment will be based on internal seminar presentation)

Departmental Elective –I (DE-II)#	Open Category course (OC-2)
560214: Quality Design and Control	800210 : Introduction to Operations Management
560215: Traditional and Non-Traditional Optimization Tools	800211 : Tools in Scientific Computing
560216: Product Design and Manufacturing	: Manufacturing Guidelines for Product Design
560217: Material characterization	

MK 03/01/12.24
DEAN (ACADEMICS)
M.I.T.S

Master of Technology (Production Engineering) (Semester-IV)

Scheme of Examination

(W.E.F JULY 2023

S.No.	Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
			Theory Slot			Practical Slot						
			End sem.	Mid sem	Quiz/ Assignment	End Sem. /Practical Viva	Sessional Work/ Practical Record/ Assignment/ Quiz/ Presentation		L	T	P	
I.	560405	Dissertation Part-II	-	-	-	300	200	500	-	-	14	14
		Total	-	-	-	300	200	500	-	-	14	14

Question | Marks | CO | BL

560211: Automation & Robotics

Category	Title	Code	Credit-3			Theory Paper
Departmental core-DC	Automation & Robotics	560211/690211	L	T	P	Max. marks: 70 Min. Marks: 28
			3	-	--	Duration: 3 hrs

Course objectives: To make the student to understand:

1. The automation and brief history of robot and applications
2. About robot end effectors, Robot Programming methods & Languages of robot.
3. Various sensors and fundamentals of vision systems.
4. The latest material handling system used in manufacturing industry and the concept of Automated Guided Vehicle System.
5. The basics of CAD/CAM integration and concept of the group technology

Syllabus

Unit-I Automation: - Definition, Reasons for automating, Types of production Automation Strategies. Detroit type Automation - Automated flow lines, Method for work part Transport, Transfer mechanism, Buffer storage, control functions, automation for Machining operations, design and fabrication considerations

Unit-II Automated Inspection & Testing: - Inspection and testing, SQC, automated inspection - Principles and methods, Sensor technologies for automated inspection, coordinate Measuring machine. other contact inspection method, machine vision, optical inspection methods, and non-contact inspection methods.

Unit-III Introduction to Robotics: - Historical development, specification, Configuration Drive and Precision of Industrial Robots, Robot end- effecters. Robots Kinematics, Direct and Inverse, Robot trajectories, Control of Robots Manipulators. Sensing: Range proximity, Touch, Force , Torque, Surface texture and vision.

Robot Programming: - Robot languages, Robot teaching. Robot level languages, Task level languages and offline programming, concept of AI in Robotics.

Unit-IV Robot Application Planning: - Product design and production planning, principles of Robot's motion economy, design of robotic workstations Performance analysis. Justification of industrial robots.

Unit-V Industrial Application of Robots: - Selection and use of Robots for foundry and casting, welding materials handling, machining inspection, assembly and painting.

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

1. **State** the concepts/components of computer integrated manufacturing and integrate them in a coordinated fashion
2. **Identify** the main elements in computer integrated manufacturing systems.
3. **Apply** computer aided process planning, feature and group technology, and data exchange in manufacturing processes.
4. **Analyze** product models with CAM tools and CNC machines.
5. **Select** the standard machining codes of programming for different materials

6. **Design** Flexible manufacturing cell after carrying out Group technology study and finally creating FMS.

Text & References Books:

1. Robotics, Controlling, Sensing, Vision & Intelligence by FU K.S. Gonzalez & Lee, McGraw Hill Book Co.
2. Robotics for Engineers, by Yoren Koren, McGraw Hill Book Co. New York.
3. Groover, M P., "Automation, Production System and CIM", Prentice-Hall of India.
4. Principles of computer integrated manufacturing- S. Kant Vajpayee, PHI Learning Private Limited,New Delhi.
5. David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi.
6. Yorem Koren, "Computer control Manufacturing Systems", McGraw Hill.
7. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International.

560212: Production Engineering-II

Category	Title	Code	Credit-3			Theory Paper
Departmental core-DC	Production Engineering-II	560212	L	T	P	Max. marks: 70 Min. Marks: 28
			3	-	--	Duration: 3 hrs

Course objectives: To make the student to understand:

1. The basic understanding of unconventional machining processes
2. The principle, mechanism of metal removal of various unconventional Machining processes
3. 3D laser forming, parametric analysis for performance evaluation
4. Concept of MRR, feed rate and new hybrid non-traditional processes
5. The various process parameters and their effect on the component machined on unconventional machining processes

Syllabus

Unit-I Modern Manufacturing Methods: -Introduction: Shape building processes & overview of new manufacturing processes. Laser bending and 3D laser forming. Brief description of High-Energy Rate Forming (HERF) processes. Thermal Metal Removal Processes: -

Unit-II Electric Discharge Machining: - Principal of EDM, Spark generators, Dielectrics and Flushing, Tool feeding system. Performance Evaluation- MRR, Surface finish & Accuracy. Tool Designs: EWR, Over cut Tapers, Performance Improvement Techniques, Principles of Working and Application of EDD, TW-EDM, EDS, EDO, CNC-EDM, AC-EDM, HEDM and Pocket EDM.

Unit-III Laser Beam Machining: - Principal of laser production, Working principles of laser beam machining. Types of Lasers, Working of Ruby and Co-laser process characteristics, Advantages, Limitations and Applications of Electron Beam Machining (EBM), Ion Beam Machining (IBM) and Plasma Beam Machining (PBM).Mechanical Processes: -

Unit-IV Ultrasonic Machining: Principle of working, USM System, Mechanics of Cutting, Parametric Analysis, Process capabilities, Advantages, Limitations and Applications.

Abrasive Jet Machining: Principle of Working, AJM setup, Gas propulsion, Abrasive Feeder, Machining chamber and nozzle, Parameter analysis for performance evaluation, Process capabilities, advantages, Limitations and Applications. Working principle and applications of Abrasive Flow Machining (AFM), Magnetic Abrasive Machining (MAM), Water Jet Cutting (WJC), and Abrasive Water Jet Machining (AWJM), Abrasive Polishing and Hydraulic Jet Cutting.

Unit-V Electro Chemical Machining: Electrolysis, Theory and Working principle of ECM, Composition, Properties and selection of electrolyte ECM machine, tool-power source, Electrolyte supply and cleaning system, tool feed system, work holding systems. Material removal rate in ECM, Dynamics and Kinematics, Smoothing of an irregular anode surface, tool design for ECM. Limitations of ECM, Principles, applications of ECG, Electro-stream drilling (BSD), ECDE, shaped-tube Electrolytic machining (STEM). Basic Techniques of CHM, Maskants, CH Milling, CHB and Petrochemical Discharge Machining (PCDM). Comparison of new methods of machining. Introduction to Electro Chemical discharge Machining and other new hybrid non-traditional Processes. Micro-machining techniques and their applications.

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

1. **Define** the basic techniques of advance machining processes.
2. **Identify** the process parameters and their effects.
3. **Demonstrate** different unconventional machining processes and the influence of difference process parameters on the performance and their applications.
4. **Compare** the machining response of different unconventional machining process.
5. **Recommend** the best machining process for different materials of various applications.
6. **Improve** the machining response using optimization techniques

ext & References Books:

1. Advance Methods of Machining by M G Gough, J.A. Chapmanand Hal London.
2. Non-traditional Manufacturing Process Engineering by Gray F. Bendictm, MARCAL, DEKK.ER Inc.
3. Modern Manufacturing Process Engineering by Niebe, Mc.Graw-Hill Int. Ed.
4. New Technology by Bhattacharya, A.IE (I) Calcutta.
5. Non-conventional Machining by Mishra, PK Narosa Publishing House, New Delhi.
6. Modern Machining Methods by Adithan, S.Chand & Co. New Delhi.
7. Modern Machining process by Pandey, PC and Shan, HS Tata Mc Graw Hill, New Delhi.
8. Manufacturing Science by Ghose, A & Malik, AK, EWP.
9. Production Technology by HMT.
10. Fundamentals of Machining and Machine Tools by Boothroyed Marcel, Dekker, Inc.
11. ASM Metals Handbook, Vol. Number Machining.
12. Production Technology by PC Sharma, S. Chand & Company Ltd.

560213: Logistics and supply chain management

Category	Title	Code	Credit-3			Theory Paper
Departmental core-DC	Logistics and supply chain management	560213	L	T	P	Max. marks: 70 Min. Marks: 28 Duration: 3 hrs
			3	-	--	

Course objectives: To make the student to understand:

1. The consumer demand for guaranteed delivery of high quality and low cost with minimal lead time
2. How to optimize pre and post production inventory levels
3. How to maintain transparency in operations
4. How to minimize variance by means of activities like standardization, variety reduction
5. How to achieve maximum efficiency in using labour, capital and plant through the company

Syllabus

Unit-I Introduction to Logistics: - Scope of Logistics, Elements of Logistics, Logistics in the system Life Cycle, Need for Logistics Engineering, Related Terms and Definitions.

Unit-II Measures of Logistics: - Reliability, Maintainability, Availability factors, Supply supports, Facility and Software Factors. System Engineering Process: - Definition of Problem and Need analysis, System Feasibility Analysis, System Operational Requirements, Functional Analysis.
Supportability Analysis: - Processes, Methods, Tools and Applications.

Unit-III Logistics in The Design and Development Phase: - Design Process, Related Design Discipline, Supplier Design Activities, Design Integration and Reviews, Test and Evaluation.
Logistics in The Production /Construction Phase: - Production/ Construction Requirements, Industrial Engineering and Operations Analysis, Quality Control, Production Operation, Transition from Production to user operation. Logistic in The Utilization and Support Phase: - System/ Product Support, TPM, Data collection, Analysis and System Evaluation, Evaluation of Logistic Support Elements, System Modification.

Unit-IV Logistics in the System Requirement, Material Recycling and Disposal Logistic Management: -Logistic Planning, Development of a Work Breakdown Structure, Scheduling of Logistics Tasks, Cost Estimation and control, Organization for Logistics, Management and control.
Unit-V Supply Chain Management: - Overview, Managing the customer interface, Managing the supplier interface. Measures of Supply chain performance, Supply Chain links to operations strategy, Supply Chain Dynamics, Supply Chain Software, Supply chain management across the organization

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

1. Apply sales and operation planning, MRP and Lean manufacturing concepts
2. Familiarized with managing the supplier interface
3. Analyze the manufacturing operations of a firm
4. Apply quality management tools or process improvement
5. Apply logistics and purchasing concepts to improve supply chain operations

& References Books:

1. Logistics Engineering and Management-Benjamin S. Blanchard.
2. Operation Manasement-Lee J Kraiewski & Larry P. Ritzman
3. Essentials of supply chain management by Michael H. Hugos
4. Logistics and supply chain management by Martin christopher
5. Supply chain management: strategy, planning and operation by sunil chopra and Peter Meindl