GOVERNMENT POLYTECHNIC MUMBAI

(Academically Autonomous Institute of Government of Maharashtra)

Department of Mechanical Engineering

P19R Curriculum

Third Semester

GOVERNMENT POLYTECHNIC MUMBAI

(Academically Autonomous Institute, Government of Maharashtra)

Teaching and Examination Scheme (P19R)

With effect from AY 2022-23

Programme: Diploma in Mechanical Engineering (Sandwich Pattern) **Term / Semester -III**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
							Theory			PR	OR	TW	Total
		L	P	TU	Total		TH	TS1	TS2				
UV19R103	UNIVERSAL HUMAN VALUES - III	--	--	--	--	2	--	--	--	--	--	--	--
ME19R203	MANUFACTURING PROCESSES	2	4	--	6	6	60	20	20	25*	--	25	**150**
ME19R210	STRENGTH OF MECHANICAL MATERIALS	3	2	--	5	5	60	20	20	--	--	25	**125**
ME19R205	BASIC THERMODYNAMICS	2	2	--	4	4	60	20	20	--	--	25	**125**
ME19R206	THEORY OF MACHINES	3	2	--	5	5	60	20	20	--	--	25	**125**
ME19R301	MACHINE DRAWING & COMPUTER AIDED DRAFTING	--	4	--	4	4	--	--	--	25*	--	25	**50**
ME19R207	FLUID MECHANICS AND MACHINERY	2	2	--	4	4	60	20	20	--	--	25	**125**
ME19R103	ENVIRONMENTAL STUDIES	--	2#	--	2	2	--	--	--	--	--	--	--
	Total	**12**	**18**	**--**	**30**	**32**	**300**	**100**	**100**	**50**	**--**	**150**	**700**
	Student Centered Activity (SCA)				**05**								
Total Contact Hours					**35**								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral,TW: Term Work (progressive assessment)

***** Indicates assessment by External Examiner else internal practical skill test, #indicates self, on- line learning Mode, **@** indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour, TH- 2 hours 30 min, PR/OR – 3 hours per batch, SCA- Library -1 hour, Sports- 2hours, Creative Activity-2 hours, # Indicates Self, on- line learning Mode through MOOCs/Spoken Tutorials /NPTEL/SWAYAM/FOSSEE etc.

Department Coordinator,
Curriculum Development,
Dept. of Mechanical Engineering

Head of Department
Dept. of Mechanical Engineering

In-Charge
Curriculum Development Cell

Principal

Programme : **Diploma in ME/CE/EE/CO/IF/IS/EC/RT/LT/LG (Sandwich Pattern), AIML**										
Course Code: UV19R103				Course Title: Universal Human Values-III						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total (Credit)	TH (2 Hrs 30min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	**--**	**-**	**02**	**-**	**-**	**-**	**--**	--	**--**	**--**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment), * Indicates assessment by External Examiner else internal practical skill test, # indicates Self, on- line learning Mode, @ indicates online examination
Note: For Minimum passing marks under various heads, refer, examination rule AR26.Two practical skill tests are to be conducted. First skill test at mid-term and second skill test at the end of the term.

Rationale:

This course aims to cultivate essential human values and ethics in students to become responsible citizens. It fosters understanding of virtues advocated by great Indian philosophers like truth, non-violence, morality and social responsibility. Students apprehend philosophies of thinkers like Mahatma Gandhi, Swami Vivekananda and Bharat Ratna Dr.Babasaheb Ambedkar; develop courage, patience and dignity through experiences of loyalty and duty; and practice yoga for well-being.

Adopting discussions, debates, visits, reports and applications, the course transforms students into strong, sensitive and virtuous members of society with high moral character and social conscience. In essence, it promotes human values, inculcates ethics and develops the best citizens of India.

Course Outcomes: On completion of this course, student should be able to

CO1	Express gratitude through compassionate service and unconditional giving.
CO2	Spread hope, optimism and cheer through positive words and deeds.
CO3	Understand responsibilities towards the planet, fellow beings and future generations.
CO4	Internalize lessons from great souls who exemplified nobility, courage and righteousness.
CO5	Appreciate life as sacred and valuable; and pursue meaning, purpose and peace.
CO6	Develop holistic well-being through balancing individual needs with common good.

Course Content Details:

Sr. No	Activity	Related Value/s	Methodology of Implementation	Student's Role	Mentor's role	Resources Required
01	Read and create abstract of biography like, 1. ek hota carver 2.Biography of a yogi 3. JRD Tata 4. Mahatma Gandhi 5. Pant pratinidhi 6. Shriman Yogi	Righteousness	Visit library, find out books, read and prepare the report	Students will need to select a biography to read and create an abstract that summarizes the key ideas and messages in the biography.	Mentors will need to provide guidance and support to help students select an appropriate biography and create a well-written abstract.	Access to a library or online resources to select a biography to read and create an abstract.
02	NDRF one day training OR Police Mitra training OR Red cross training OR Fire safety training OR Self defense training for Girls OR CPR training	Accountability Empathy	Plan training with the help of related agencies	Students will need to attend a one-day training session.	Mentors will need to provide guidance on attending the selected training session and ensuring safety.	Access to training facilities and materials may be necessary.

03	Debate on a particular topic among group of students	Clarity of thoughts Politeness	Prepare small groups of students, Choose topics. Avoid controversial topics	Students will need to participate in a debate on a given topic and follow the rules for participation.	Mentors will need to provide guidance on debate topics and rules for participation and provide feedback on students' performance.	A list of debate topics and rules for participation may be required.
04	List different incidents witnessed by you related to loyalty and write a report on it	Loyalty	List related incidents, discuss with mentor and write report.	Students will need to observe and report on incidents related to loyalty and submit a report summarizing their findings.	Mentors will need to provide guidelines on what should be included in the report and provide feedback on students' observations.	A template for the report or guidelines on what should be included may be helpful.
05	Analyse behaviour pattern of self and group member while performing any group activity	Harmony in behavior	List different group activities, select anyone from the list and perform it.	Students will need to analyze their own behavior and that of their group members during a group activity and record their observations.	Mentors will need to provide guidance on observing and recording behavior patterns and provide feedback on students' observations.	Guidelines for observing and recording behavior patterns may be necessary.

06	Visit tribal area and spread awareness about sanitary practices,hygiene and education	Empathy Social Gratitude Selflessness	List nearby tribal areas and prepare detailed plans.	Students will need to plan and conduct an awareness campaign in a tribal area to educate the local community on a selected topic.	Mentors will need to provide guidance on planning and conducting an awareness campaign and provide feedback on students' materials and presentations.	Materials for creating educational materials or presentations may be needed.
07	Visit websites of reputed industries and study their Corporate Social Responsibility (CSR) activities. Also arrange an interview of a successful entrepreneur.	Social Gratitude Accountability	Visit CSR section of the website of selected industry	Students will need to research and report on the CSR activities of a selected industry.	Mentors will need to provide guidance on researching and reporting on CSR activities and provide feedback on students' reports.	Access to the internet or relevant industry publications may be required.
08	1.Seven blunders told by Mahatma Gandhi and practice them as an ethic in your daily life to be a moral citizen. 2. Swami Vivekananda and his philosophy 3.Bharatratna Dr Babasaheb Ambedkar and his philosophy, teachings Any other social reformer	Character Humanity Sacrifice Honesty Accountability Patriotism	Select anyone topic. Prepare Group presentations on selected topic.	Students will need to prepare and present a group presentation on a selected topic.	Mentors will need to provide guidance on preparing and presenting a group presentation and provide feedback on students' presentations.	

09	Understanding Eight limbs (Ashtanga) of Yoga for gaining the best mental health.	Health consciousness Social gratitude	Arrange the session of a meditation expert to understand the philosophy of Yoga.	Students will need to understand and practice the principles of the eight limbs of yoga. Practice it daily for the best physical and mental health.	Mentors will need to provide guidance on understanding and practicing the principles of the eight limbs of yoga and provide feedback on students' progress.	Resources such as yoga mats or printed materials on the eight limbs of yoga may be required.
10	Eight-fold ashtangik path for cessation of sufferings OR Vipassana	Truthfulness Non-violence Contentment Persistence	To understand the philosophy and its use to stop suffering	After understanding share the experiences with others. Apply it in your daily life.	Provide related resources	https://en.wikipedia.org/wiki/Ashtanga_(eight_limbs_of_yoga)
11	Writing daily diary	Honesty Punctuality	Student to write diary every day	Students will need to write a daily diary entry reflecting on their thoughts, feelings, and experiences.	Mentors will need to check and provide feedback on daily diary entries to encourage reflection and self-awareness.	Each student will need a notebook or journal.

Methodology:

1. The course is Non Examination, Credit Course.
2. The course will be introduced during the student induction programme (orientation programme) of one week duration. Most of the activities are to be completed during induction programme and to be continued throughout the term during SCA hours under the guidance of mentor.
3. The mentor will be assigned to the student for a group of 20 students each.

4. In consultation and under supervision of a mentor, the student/ Group of students has to complete the activity.
5. Activities no. 6,7, 9 and 10 can be performed in collaboration with related government organizations or industries (under CSR activity).
6. All events will be organized and managed by students. The mentor will work as a facilitator/ advisor.
7. The strategies to learn the course is "Self- Exploratory" and "Experiential Learning"
8. The onus of responsibility for completing the activities is with students.
9. The student has to complete at least **five** no. of activities throughout the term to earn the credits.
10. Activity no.6 is compulsory.
11. Students will write reports on each activity performed and submit it to mentors to earn credits.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria, Excel Books, New Delhi, 2010	978-8-174-46781-2
2	Human Values	A.N. Tripathy, New Age International Publishers, 2003	978-8-122-42589-5
3	Teacher's Manual - A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria, Excel Books, New Delhi, 2010	-
4	Science and Humanism, Towards a Unified World View	PL Dhar, RR Gaur, Commonwealth Publications, 1992	978-8-171-69222-4
5	Education for values in schools- a framework	NCERT	
6	Value oriented education	E N Gawande	
7	Autobiography of a Yogi	Paramahansa Yogananda, Yogoda Satsanga Society of India; Complete edition (9 February 1998)	978-8189535513
8	Teachings of Swami Vivekananda	Swami Vivekanada, Vedanta Pr; Fifth edition (1 June 1971)	978-8185301877

E-References:

1) **https://youtu.be/kOJu1vj_BVk (The 10 Most Important Human Values)**
2) **https://youtu.be/QeogOlzG2ls (Value of Education -short film)**

E-References for mentors:

1) https://www.edutopia.org/
2) https://en.wikipedia.org/wiki/Seven_Social_Sins

Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Dr. L.A. Patil	Principal (Retired)	Pratap College, Amalner
2	Dr. Nitin Deshpande	Lead Consultant	Dnyanpeeth Academy, Pune
3	Dr. Chandrakant Shahasane	Founder Trustee	Karnala Charitable Trust, Pune
4	Mr. U.A. Agnihotri	Lecturer, Mechanical Engineering	Government Polytechnic, Mumbai
5	Mr. K. V. Patil	Lecturer, Mechanical Engineering	Government Polytechnic, Mumbai

Institute Coordinator,
Curriculum Development,

Principal
Government Polytechnic, Mumbai

Programme : **Diploma in Mechanical Engineering (Sandwich Pattern)**										
Course Code: ME19R203				Course Title: Manufacturing Processes						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
2	4	--	6	60	20	20	25*	--	25	150

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill tests are to be conducted. First skill test at mid-term and second skill test at the end of the term.

Rationale:

Manufacturing is the basic area for any mechanical engineering technician. The technician should be exposed to basic manufacturing processes. This course will help the student to get familiarized with working principle and operation like turning, drilling, milling, casting, and joining processes etc. Basic knowledge of these processes will help the technician to select most appropriate process for getting the desired results in terms of getting raw material converted in to finish product, as per the requirement.

Course Outcomes: Student should be able to

CO1	Describe basic foundry procedures
CO2	Describe sheet metal presses and press operations
CO3	Describe basic joining processes and their applications
CO4	Describe construction and various operations carried out using lathe and boring machine
CO5	Describe constructional features, types of milling machines and drilling machines and operations using them
CO6	Describe grinding machines, operations performed using them and surface treatment processes

Course Content Details:

Unit No	Topics / Sub-topics
1	**Foundry Practice:** 1.1. Pattern materials, types of patterns, pattern allowances, color coding, moulding tools and equipment, 1.2. Moulding sands, types of sands, sand properties, 1.3. Elements of sand moulds, Machine molding, 1.4. Permanent mould casting-Gravity & Pressure Die casting, 1.5. Cupola furnace, defects in castings and remedies, 1.6. Safety precautions in foundry **Course Outcome: CO1 Teaching Hours :04 Marks: 08 (R- 0, U-4, A-4)**

2	**Press Working:** 2.1 Types of presses, press specification, parts of press, press classification, 2.2 Press tools: dies and punches, Press operations, Elements of press tool, 2.3 Safety while working in press shop **Course Outcome: CO2, Teaching Hours :04 Marks: 06 (R- 0, U-2, A-4)**
3	**Joining Processes:** 3.1 Principle of welding processes, Classification of welding processes, 3.2 Arc welding- Welding machines, Contents of electrodes for arc welding, manual arc welding, TIG/MIG welding, Submerged arc welding, hydrogen arc welding, 3.3 Gas welding set up for oxy acetylene welding, types of flames, their applications, 3.4 Resistance welding- Spot, seam, projection, butt resistance welding, 3.5 Defects in welding and their causes. 3.6 Brazing and soldering-process & applications, 3.7 Safety precautions in joining processes. **Course Outcome: CO3 Teaching Hours :04 Marks: 08 (R- 2,U-2, A-4**
4	**Lathe Machines:** 4.1 Centre lathe specification, different parts. Lathe classification, 4.2 Lathe operations: turning, boring, parting off, knurling, facing, drilling, taper turning, thread cutting. 4.3 Single point cutting tool geometry, 4.4 Safety precautions while working on lathe **Course Outcome: CO4 Teaching Hours :04 Marks: 08 (R- 2, U-4, A-2)**
5	**Milling machine:** 5.1 Milling machines classification, different parts of Column and Knee type milling machine, 5.2 Milling machine operations. 5.3 Down milling, up milling, plain milling cutter, 5.4 Gear cutting with simple indexing 5.5 Safety precautions while working on milling machines **Course Outcome: CO5 Teaching Hours :04 Marks: 08 (R-2, U-4,A-2)**
6	**Drilling machines:** 6.1 Classification of drilling machines, 6.2 Different parts of Radial drilling machine and Column type drilling machine, 6.3 Drilling machine operations. 6.4 Twist drill nomenclature, 6.5 Safety precautions while working on drilling machines **Course Outcome: CO5 Teaching Hours :04 Marks: 08 (R-2, U-4, A-2)**

7	**Boring Machines:** 7.1 Classification of boring machines, Different parts of horizontal boring machine, specification of boring machine. 7.2 Operations of boring machine, 7.3 Boring head, facing head, boring tools, 7.4 Safety precautions while working on boring machine **Course Outcome: CO4 Teaching Hours :04 Marks: 06 (R-2, U-2, A-2)**
8	**Grinding Machines and Surface Treatments** 8.1 Classification of grinding machines, 8.2 Grinding machine operations, 8.3 Grinding wheel: abrasives, grit, bond, grades, structure, and grinding wheel specification. 8.4 Safety precautions while working on grinding machine. 8.5 Surface Treatment, Need of surface treatment, Surface anodizing, Cadmium coating, Galvanizing, 8.6 Safety precautions in surface treatments **Course Outcome: CO6 Teaching Hours :04 Marks: 08 (R-2, U-2, A-4)**

Suggested Specifications Table (Theory)

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Foundry Practice**	-	4	4	8
2	**Press Work**	-	2	4	6
3	**Joining Processes**	2	2	4	8
4	**Lathe Machine**	2	4	2	8
5	**Milling Machine**	2	4	2	8
6	**Drilling Machine**	2	4	2	8
7	**Boring Machine**	2	2	2	6
8	**Grinding Machine**	2	2	4	8
	Total	**12**	**24**	**24**	**60**

List of Practicals:

Sr. No.	Unit No	List of Experiments	CO	Hours
1	1	Making one wooden pattern	CO1	8
2	1	Making one simple job on moulding	CO1	6
3	2	One simple job on press	CO2	4
4	3	Making a simple job on welding joint	CO3	6
5	4	One plain turning job on center lathe	CO4	6
6	4	One job on thread cutting, chamfering, filling on centre lathe	CO4	8
7	4	One job on step turning, taper turning on lathe	CO4	8
8	5	One job of gear cutting on milling machine and lathe	CO5	8
9	8	Tool grinding practice	CO6	6
		Total		60

Instructions:

- **A specimen job is to be prepared and demonstrated by concerned workshop instructor before giving job to the students.**
- **Students will maintain a diary containing the details of the job as above.**
- **Theory contents are to be taught by faculty /workshop superintendent.**
- **Term end practical examinations on one of above machines for three hours duration**

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Introduction to Manufacturing Processes	Jhon Schey, Mcgraw Hills, 2012	978-0071-1691-10
2	A course in of Workshop Technology Volume. I	B S Raghuwanshi, Dhanpatrai & Sons, 2017	978-1020092015
3	Elements of Workshop Technology Vol. II (Machine Tools)	Hajra Chawdhury, Media Promotors and Publications Pvt. Ltd. 15th Ed, 2008	978-8185099156
4	Elements of Workshop Technology Vol. I (Manufacturing Processes)	Hajra Chawdhury, Media Promotors and Publications Pvt. Ltd. 15th Ed, 2008	978-8185099149

E-References:

- www.engineeringpractice.org>lathe
- www.hnsa.org>wp-contents
- www.learmmechanical.com>drillingmachine
- www.americanamchinist.com>article>cuttingtools
- www.theengineerspost.com>broachingmachine www.reliance-foundry.com
- www.eskaymachine.com

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	2	2	2	1	2	2	3	3
CO2	2	2	2	1	1	2	2	2	3
CO3	3	2	2	2	1	3	2	2	2
CO4	3	2	2	3	2	3	2	3	3
CO5	2	2	2	3	2	2	2	2	2
CO6	1	2	2	2	1	1	2	1	2

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Hiremath P.	Sr. Engineer	Reliance Industries, Navi Mumbai
2	Mr. Rao V B	Asst. Professor	Fr. C.R.C. Engg, Mumbai
3	Mr. Puralkar Mohanish	Manager, R&D	Miles Ahead Tech Pvt Ltd
4	Mr. Ambadekar N M	Work shop Superintendent	Govt. Polytechnic, Thane
	Mr. Joshi S. V.	Lecturer in Mech. Engg.	Govt. Polytechnic, Mumbai
	Mr. Ansari N N	Lecturer in Mech. Engg.	Govt. Polytechnic, Mumbai

Coordinator,
Curriculum Development,
Department of Mechanical Engineering

Head of Department
Department of Mechanical Engineering

I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Mechanical Engineering (Sandwich Pattern)**										
Course Code: **ME19R210**				Course Title: **Strength of Mechanical Materials**						
Compulsory / Optional: Compulsory subject										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs. 30 min)	TS1 (1 Hr.)	TS2 (1 Hr.)	PR	OR	TW	Total
3	2	-	5	60	20	20	-	-	25	125

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid-term and second skill test at the end of the term.

Rationale: Diploma holders in this course are required to analyse reasons for failure of different components and select the required materials for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts, columns and springs. Hence this subject has been introduced. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles to the solution of applied problems to develop the required competencies.

Course Outcomes: Student should be able to

CO1	Analyze/compare various mechanical properties and develop theoretical basics for axial loading, bending and buckling.
CO2	Calculate principal stresses using analytical and graphical Mohr's circle diagram
CO3	Solve moment of inertia for different sections, section modulus and bending stress.
CO4	Draw shear force diagram & bending moment diagram and calculating slope/deflection for the structural components subjected to lateral loading.
CO5	Analyze direct/bending stresses, Eccentric and Buckling load.
CO6	Evaluate strain energy stored in the element subjected to gradual/sudden/impact loads and numerical on torsional shear stress

Course Content Details:

Unit No	Topics / Sub-topics
1	**Mechanical Properties of Materials, Simple stresses & Strains** 1.1 Types of loads, Simple stresses & strains viz. tensile, compressive, Shear, Crushing, Thermal stresses, Hoop stresses & corresponding strains, Volumetric Strain, Bulk modulus, Hook's law, Young's modulus, Modulus of Rigidity, stress-strain curves for ductile & brittle materials, Poisson's ratio. 1.2 Concepts of Buckling – Rankine's & Euler's formulae for buckling load for columns / shafts under compression, concepts of equivalent length for various end conditions. (Problems on compressive & tensile stresses, Thermal stresses, butt & lap riveted joints, simple cases of buckling). 1.3 Concepts of Deflection & slope of beams – relation between bending moment & slope. Deflection of simply supported beams and cantilever beams subjected to point load. (No derivation) **Course Outcome: CO1, Teaching Hours: 8 Marks: 10(R-2, U-4, A-4)**
2	**Principal planes & Principal stresses** **2.1** Concept of principal planes & stresses. Definition of principal planes, principal stresses, oblique plane and obliquity. **2.2** Different states of stresses, normal & tangential stress on oblique plane, resultant stress. **2.3** Analytical and graphical method (Mohr's Circle) for locating principal plane and calculating principal stresses for uniaxial/biaxial loading. **Course Outcome: CO2 Teaching Hours : 6 Marks: 10 (R-2, U-4, A-4)**
3	**Moment of Inertia & Bending stresses** 3.1 **Moment of Inertia** 3.1.1 Moment of Inertia (M I): M.I. for plane areas, radius of gyration, M.I for regular plane areas 3.1.2 Rectangle, triangle, circle, semi-circle, hollow rectangular and hollow circular section. 3.1.3 Parallel axes theorem & Perpendicular axes theorem (no derivation) 3.1.4 M.I of symmetrical and unsymmetrical I sections, channel and angle sections and T section. M.I of built up sections symmetrical and unsymmetrical about centroidal axis. 3.2 **Bending stresses** 3.2.1 Theory of simple bending, equation of bending. 3.2.2 Assumptions in the theory of bending, moment of resistance, section modulus & neutral axis. Simple numerical. **Course Outcome: CO3 Teaching Hours: 8 Marks: 10(R-2, U-4, A-4)**
4	**Shear Force & Bending Moment** 4.1 Types of beams, types of supports, concept and definition of Shear force (S.F) and bending moment (B.M). 4.2 S.F and B.M diagrams for simply supported, overhang beams subjected to point load & UDL. Location of point of contraflexure and maximum bending moment calculations (if any).

	(No problem to be set for External moment or couple), 4.3 S.F and B.M diagrams for cantilever subjected to point load & UDL. Location of point of contraflexure and maximum bending moment calculations (if any). (No problem to be for External moment or couple) **Course Outcome: CO4 Teaching Hours: 10 Marks: 12 (R-2, U-6, A-4)**
5	**Direct and bending stresses** 5.1 Concept of direct and bending stresses, section modulus. 5.2 Eccentric loads, core or kernel of section, middle third rule, middle fourth rule. 5.3 Members of uniform sections subjected to eccentric loads with eccentricity and stress distribution at the base. 5.4 Structure subjected to horizontal, vertical loads e.g. tie bars, columns etc. **Course Outcome: CO5 Teaching Hours: 6 Marks: 8 (R-0, U-4, A-4)**
6	**Strain Energy & Torsion** **6.1 Strain Energy** 6.1.1 Definition and Concept of Strain energy, 6.1.2 Types of loading gradual, sudden & Impact loading. 6.1.3 Stresses developed due to gradual, sudden & impact load. 6.1.4 Strain energy stored due to gradual, sudden & impact loading. 6.1.5 Resilience, proof resilience and modulus resilience. **6.2 Torsion** 6.2.1 Stresses, strain & deformations in determinate shafts of solid & hollow, Homogeneous & composite circular cross section subjected to twisting moment. 6.2.2 Derivation of torsion equation. Simple Numericals **Course Outcome: CO6 Teaching Hours: 7 Marks: 10 (R-2, U-4, A-4)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Mechanical Properties of Materials, Simple stresses & Strains**	2	4	4	10
2	**Principal planes & Principal stresses**	2	4	4	10
3	**Moment of Inertia & Bending stresses**	2	4	4	10
4	**Shear Force & Bending Moment**	2	6	4	12
5	**Direct and bending stresses**	-	4	4	08
6	**Energy & Torsion**	2	4	4	10
	Total	**10**	**26**	**24**	**60**

List of experiments:

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Tensile test on Mild steel/ Aluminium specimen, plotting of stress strain curve and indicating significant point as per I.S. requirement	04
2	1	CO1	Izod impact test on M.S., Copper, Aluminum and Brass	02
3	2	CO2	To find principal stresses and to locate principal plane using Mohr circle method and validate the same with numerical method. (Two different cases)	02
4	2 and 4	CO3 and CO4	Bending test on mild steel/timber.	04
5	3	CO3	Assignment on Moment of Inertia & Bending stresses.	02
6	4	CO4	To draw shear force and bending moment diagram for different kinds of loads	02
7	5	CO5	Assignment on Direct and bending stresses.	02
8	6	CO6	Assignment on Strain Energy & Torsion.	02
9	1	CO1	Shear test – Single and double shear for mild steel bar	02
10	1	CO4	Deflection test on timber / metal specimen	02
11	6	CO6	Torsion test on metal bar	02
12	1	CO1	Hardness test (Brinell Hardness) on various metals.	02
13	1	CO1	Compression testing on metal/timber.	02
			Total	**30**

Note: All experiments/assignments are compulsory

References/ Books:

Sr. No	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Strength of Materials	S. Timoshenko, D. Van Nostrand Company Inc. 3rd Ed, 1956	978-1124-1550-98
2	Strength of Materials	R.K. Bansal, Laxmi Publication Pvt Ltd. Revised Ed, 2010	978-8131-8081-46
3	Strength of Materials	R. K. Rajput, S. Chand & Company Ltd., 5th Ed, 2015	978-9385-4013-67
4	Strength of Materials	S. Ramamrutham, Dhanpat Rai and sons Publishing House, 16th Ed, 2011	978-9384-3782-64
5	Text Book of Strength of Materials	R.S. Khurmi, S. Chand & Company Ltd. 2015	978-9385-4019-54
6	Study of Materials	Ferdinand L. Singer, Harper & Row Publisher, New York, 4th Ed	978-0063-5059-95

E-References:

1) https://nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/strength%20of%20materials/homepage.htm
2) https://onlinecourses.nptel.ac.in/noc17_ce22/preview
3) https://nptel.ac.in/Aeronautical/Strength%20of%20Materials/course_strength%20of%20materials.pdf

4) https://www.slideshare.net/khagendragautam/strength-of-material-3-som-mechanical-engineering-handwritten-classes-notes-study-materials-for-ies-ps-us-gate

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	2	2	1	2	1	3	2	1
CO2	2	3	2	1	2	2	3	2	1
CO3	3	2	3	2	2	2	3	3	1
CO4	3	3	3	2	2	2	3	3	1
CO5	3	3	3	2	2	2	3	3	1
CO6	1	3	3	2	2	2	3	3	1

Industry Consultation Committee:

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Coordinator,
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Head of Department
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I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Mechanical Engineering (Sandwich Pattern)**										
Course Code:**ME19R205**				Course Title: **Basic Thermodynamics**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2.5 Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
2	**2**	**--**	**04**	**60**	**20**	**20**	**--**	**--**	**25**	**125**

Abbreviations: TH- Theory; PR-Practical; TU-Tutorial; TS1 and TS2- Term Tests; OR-Oral Exam; TW: Term Work (progressive assessment), * Indicates assessment by External Examiner else internal assessment
Note: For Minimum passing marks under various heads, refer, examination rule AR26.

Rationale: Basic thermodynamics is one of the core engineering subjects for mechanical engineering students. A diploma holder is supposed to maintain steam generators, turbines, compressors, IC engines, refrigerators and other power plant equipment. Therefore, it is essential to impart him basic concepts of thermodynamics, steam generators, steam turbines, and heat exchangers. This course will enable students to establish foundation required to design, operate and maintain these devices.

Course Outcomes: Student should be able to

CO1	Describe the basic concepts of thermodynamics.
CO2	Apply gas laws for given processes.
CO3	Describe various thermodynamic reversible processes.
CO4	Apply first and second law for the thermodynamic systems.
CO5	Describe the working, construction and applications of steam boilers.
CO6	Describe different modes of heat transfer.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Fundamental Concepts** 1.1 Thermodynamic state and system, boundary, surrounding, universe. Thermodynamic systems-closed, open, isolated, adiabatic, homogeneous and heterogeneous, macroscopic and microscopic. Industrial examples of different thermodynamic systems. 1.2 Properties of system – intensive and extensive, thermodynamic equilibrium, quasi – static process, reversible and irreversible processes. 1.3 Zeroth law of thermodynamics, definition of properties like pressure, volume, temperature, enthalpy, internal energy. **Course Outcome: CO1 Teaching Hours : 06 Marks: 10 (R- 4, U-2, A-4)**
2	**Ideal Gases** 2.1 Definition of an ideal gas, explanation of ideal gas laws – Boyle's law, Charle's law, Gay-Lussac's Law, Avogadro's law. 2.2 Universal gas constant, Characteristic gas constants, Specific heat at constant pressure, specific heat at constant volume of gas, simple problems on gas equation. **Course Outcome:CO2 Teaching Hours : 03 Marks:08 (R- 2 , U-2 , A-4)**

3	**Thermodynamic Processes on Gases** 3.1Types of thermodynamic processes – isochoric, isobaric, isothermal, hyperbolic, isentropic, polytropic and throttling processes, 3.2 Equations representing the processes Derivation of work done, change in internal energy, rate of heat transfer for the above processes. **Course Outcome: CO3 Teaching Hours : 03 Marks:08 (R-2 , U-2 , A-4)**
4	**Laws of Thermodynamics** 4.1 Laws of conservation of energy, first law of thermodynamics (Joule's experiment), Limitations of first law of thermodynamics, Application of first law of thermodynamics to non-flow systems -Constant volume, constant pressure, Adiabatic and polytropic processes. 4.2 Steady flow energy equation, Application of steady flow energy to equation, turbines, pump, boilers, nozzles. 4.3 Heat source and heat sinks, statement of second laws of thermodynamics: Kelvin Planck's statement, Clasius statement, Perpetual motion Machine of first kind, second kind, Carnot engine, Introduction of third law of thermodynamics, concept of irreversibility, entropy. **Course Outcome: CO4 Teaching Hours :07 Marks:12 (R-4 , U-2 , A-6)**
5	**Properties of Steam& Steam Generators** 5.1Formation of steam and related terms, thermodynamics properties of steam, steam tables, internal latent heat, internal energy of steam, Mollier diagram (H – S Chart), Expansion of steam, Hyperbolic, reversible adiabatic and throttling processes Quality of steam (dryness fraction).(Numerical) 5.2 Steam Generators **:** Uses of steam, classification of boilers, comparison of fire tube and water tube boilers. Construction features of Cochran, La-mont and Loeffler, Lancashire boiler, Babcock & Wilcox Boiler. Boiler mountings and accessories, Introduction to modern boilers. **Course Outcome: CO5 Teaching Hours : 06 Marks:12 (R-2 , U-4 , A-6)**
6	**Introduction to Heat Transfer** 6.1Modes of heat transfer conduction, convection and radiation. 6.2Conduction- Fourier's law, thermal conductivity conduction through cylinder, thermal resistance, composite walls, list of conducting and insulating materials. 6.3 Convection- Newton's law of cooling, Natural and forced convection. 6.4 Radiation- thermal radiation, absorptivity, emissivity, black and grey bodies, Stefan – Boltzmann law. 6.5 Heat exchangers – classification, construction and working of shell and tube, shell and coil, pipe in pipe type and plate type heat exchanger. **Course Outcome: CO6 Teaching Hours : 05 Marks: 10 (R-2 , U-4 , A-4)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Fundamental Concepts**	4	2	4	10
2	**Ideal Gases**	2	2	4	8
3	**Thermodynamic Processes on Gases**	2	2	4	8
4	**Laws of Thermodynamics**	4	2	06	12
5	**Properties of Steam & Steam Generators**	2	4	06	12
6	**Introduction to Heat Transfer**	2	4	4	10
Total		**16**	**16**	**28**	**60**

List of experiments:

Sr. No.	Unit No	COs	Title of the Experiments / Assignment	Hours
1	1	CO1	Assignment on fundamental concepts of thermodynamics.	02
2	2	CO2	Assignment on ideal gases.	02
3	3	CO3	Assignment on thermodynamic processes on Gases.	02
4	4	CO4	Assignment on Laws of Thermodynamics.	02
5	5	CO5	Demonstration of working of different types of boilers. Such as Nestler boiler, Cochran, La-mont and Loeffler, Lancashire boiler, Babcock & Wilcox Boiler.	04
6	5	CO5	Study of boiler of mountings.	02
7	5	CO5	Study of boiler accessories.	02
8	5	CO5	Determination of dryness fraction of a given sample of steam by using separating calorimeter.	02
9	5	CO5	Visit to Sugar factory or boiler in industry.	02
10	6	CO6	Demonstration of heat transfer through conduction, convection and Radiation	02
11	6	CO6	Calculate thermal conductivity of metallic rod.	04
12	6	CO6	Identify different equipment in power engineering lab having heat exchangers and classify heat exchangers. Write construction and working of any 03 of above heat exchangers.	04
Total				**30**

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Engineering Thermodynamics	PK Nag; Tata McGraw Hill,Delhi.	0-07-026062-1
2	Basic Engineering Thermodynamics	Roy Chaudhary; Tata McGraw Hill,Delhi.	9780070965881
3	Engineering Thermodynamics	CP Arora; Tata McGraw Hill,Delhi.	0-07-462014-2
4	Thermal Engineering	R.S. Khurmi,& J.K.Gupta S. Chand Technical Publication	9788121925730
5	Thermal Engineering	P.L.Ballaney ,Khanna Publication	978-8174090317
6	A Course in Thermal Engineering	Domkundwar .S, Kothandaraman C. P. Domkundwar, Dhanpat Rai & sons.	9788177000214
7	Thermal Engineering	M.M.Rathore, Tata McGraw Hill.	9780070681132
8	Thermal Engineering	Rajput R.K, Firewall Media, New Delhi 2005	9788170088349

E-References:

1. https://swayam.gov.in/
2. www.youtube.com
3. https://learnengineering.org/
4. https://nptel.ac.in/

CO Vs PO and CO Vs PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	2	2	1	2	2	2	1
CO2	2	2	1	1	2	2	1	2	2
CO3	3	2	2	2	2	2	2	2	3
CO4	3	3	3	2	2	1	2	2	3
CO5	3	3	3	2	2	2	2	2	3
CO6	3	2	2	2	2	1	2	2	3

Industry Consultation Committee:

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Head of Department
Department of Mechanical Engineering

I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Mechanical Engineering (Sandwich Pattern)**										
Course Code: **ME19R206**				Course Title: **Theory of Machines**						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2Hrs. 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
3	**2**	**-**	**5**	**60**	**20**	**20**	**-**	**-**	**25**	**125**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale: In industries, the Mechanical Engineers/Technicians are supposed to manage functioning of equipment with proper planning, operation and maintenance of equipment. Such a functional requirement needs knowledge and skills of various motion and force transforming mechanisms and devices, such as four bar mechanism, belt pulley, clutches, flywheel, etc. This course is included in the curriculum to provide such necessary knowledge and skills in the area of mechanical equipment and devices to help in understanding of kinematics & dynamics of different equipment being used in industry. Thus, it is a key course for Mechanical Engineers/Technicians to develop following skills: i. Draw inversions and determine velocity and acceleration of different mechanisms. ii. Construct different types of cam profile for a given data. iii. Calculate loss of power due to friction in various machine elements. iv. Solve problems on power transmission. v. Construct turning moment diagram. vi. Calculate balancing mass and its position.

Course Outcomes: Student should be able to

CO1	Identify kinematic parameters of machine.
CO2	Explain the kinematic/Geometric relationship of motion parameters
CO3	Explain working of flywheel/governor and balancing of machine elements
CO4	Draw profile of radial cam with knife edge / roller follower
CO5	Calculate power transmission in belt drives
CO6	Explain working of dynamometers and power transmission in cutches/brakes

Course Content Details:

Unit No	Topics / Sub-topics
1	**Fundamentals of Kinematics and Mechanisms** 1.1. Definition of Kinematics, Dynamics, statics, Kinetics, Kinematics link, Kinematics pair and its types, 1.2. Constrained motion and its types, Kinematic chain and its types, machine and structure. Mechanism, Degree of freedom. 1.3. Inversions of Kinematic Chain: Four bar chain, Single slider Crank and Double Slider Crank Chain **Course Outcome: CO1 Teaching Hours : 6 Marks: 8 (R- 4 U-4, A-0)**
2	**Kinematic Analysis of Plane Mechanism**: 2.1. Concept of relative velocity and relative acceleration of a point on a link, angular acceleration, inter-relation between linear and angular velocity and acceleration. Drawing of velocity and acceleration diagram of simple Mechanism. 2.2. Determination of velocity and acceleration of point on link by relative method (Excluding Coriolis's component of acceleration). 2.3. Analytical method and Klein's construction to determine velocity and acceleration of different links of single slider crank mechanism. **Course Outcome: CO2 Teaching Hours : 8 Marks: 12 (R-2, U-4,A-6)**
3	**Flywheel , Governor and balancing** 3.1. **Flywheel:** Flywheel –Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C Engine (no numerical) Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance. 3.2. **Governors**: Types, concept, function and application and Terminology of Governors. Comparison between Flywheel and Governor. 3.3. **Balancing:** Introduction Static Balancing, Dynamic Balancing. Concept of Balancing, balancing of single revolving mass, Graphical and numerical method for balancing several masses in the same plane. **Course Outcome: CO3 Teaching Hours : 8 Marks: 10 (R-2 , U- 4,A-4)**
4	**Cam and Followers** 4.1. Concept, definition and application of Cams and followers. 4.2. Classification of Cams and followers Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation. 4.3. Drawing of profile of radial cam with knife edge and roller follower with and without offset with reciprocating motion. **Course Outcome: CO4 Teaching Hours : 7 Marks: 10 (R- 4 , U- 0 , A- 6)**
5	**Power Transmission** 5.1. Belt Drives- flat belt, V-belt & its applications, material for flat and V-belt. Selection of belts, angle of lap belt length Slip and creep. Determination of velocity ratio, of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission (Simple numerical). 5.2. Chain Drives- Types of chains and sprockets, velocity ratio. Advantages & Disadvantages of chain drive over other drives, Selection of Chain & Sprocket wheels, methods of lubrication.

Unit No	Topics / Sub-topics
	5.3. Gear Drives – Spur gear terminology, types of gear trains and Law of gearing. **Course Outcome:CO5 Teaching Hours : 8 Marks:10 (R-4 , U-0 , A- 6)**
6	**Friction Bearing & Clutches, Brakes and Dynamometer** 6.1. Definition of friction, its necessity, Laws of friction, Friction between dry surfaces, coefficient of friction. Pivot and collar friction, uniform pressure and uniform wear assumptions, power absorbed in flat, and conical pivot bearings. Study of single plate, multiple plate, cone and centrifugal clutch. Simple numerical on power transmitted by them. 6.2. Definition Classification and comparison between brakes and dynamometers. Construction and working of Block brake, Band brake, Combined block and band brake, Internality expanding shoe brake and disc brake. (Numerical to find braking force and braking torque and power for block, band and block and band brake). 6.3. Construction and working of Rope brake dynamometer, Hydraulic dynamometer and Belt type transmission dynamometer. **Course Outcome: CO6 Teaching Hours : 8 Marks: 10 (R-2 , U- 4 , A-4)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Fundamentals of Kinematics and Mechanisms**	4	4	0	08
2	**Kinematic Analysis of Plane Mechanism**	2	4	6	12
3	**Flywheel , Governor and balancing**	2	4	4	10
4	**Cam and Followers**	4	0	6	10
5	**Power Transmission**	4	0	6	10
6	**Friction Bearing & Clutches, Brakes and Dynamometer**	2	4	4	10
	Total	**18**	**16**	**26**	**60**

List of experiments:

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Describe working of mechanisms and their inversions.	02
2	1	CO1	Mini project : Prepare any two models of mechanisms or inversions.	04
3	2	CO2	Determine and draw velocity and acceleration diagram using relative velocity method for any four problems.	04
4	2	CO2	Draw Klein's Construction for Single slider mechanism.	04

Sr. No.	Unit No	COs	Title of the Experiments	Hours
5	3	CO3	Determine analytically and graphically balancing of several masses rotating in a single plane (Minimum two problems).	04
6	4	CO4	Draw two cam profiles on drawing sheets for the problems having without offset.	04
7	4	CO4	Draw two cam profiles on drawing sheets for the problems having with offset.	04
8	5 & 6	CO5 CO6	Mini Project: 1. Compile information from internet related to various mechanisms/elements like piston, crank, connecting rod, cam, clutch, brake, flywheel, governor, or animation of mechanism etc. along with functions of each and prepare presentation. 2. Assignment on nomenclature of Helical Gears and worm and worm wheel	04
Total				**30**

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Theory of Machines	R. S. Khurmi and J. K. Gupta, S. Chand and Co. Ltd., 14th edition, 1976	978-8121-9252-42
2	Theory of Machines	P. L.Ballaney, Khanna Publication, 25th edition, 1965	978-8174-0912-22
3	Theory of Machines	S.S. Rattan, McGraw Hill India, 5th edition, July 10, 2019	978-9353-1662-81
4	Theory of Machines	Sadhu Singh, Pearson Education India, 2005	978-8177-5812-70
5	Theory of Machines	Thomson Bevan, Persons Education Ltd, 3rd edition, 2010	978-8131-7296-56

E-References:

1. https://nptel.ac.in/
2. https://www.slideshare.net/ahirehemant/theory-of-machine
3. https://www.youtube.com/watch?v=jzNik6PEKG8
4. https://www.youtube.com/watch?v=MJeRFzs4oRU

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	3	2	2	2	2	2
CO2	2	2	3	3	2	2	3	3	2
CO3	2	2	2	3	2	2	3	3	2
CO4	2	2	2	3	2	2	3	3	2
CO5	2	2	2	2	2	2	3	2	2
CO6	2	2	2	2	2	2	3	2	2

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I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Mechanical Engineering (Sandwich Pattern)**										
Course Code: ME19R301				Course Title: **Machine Drawing & Computer Aided Drafting**						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
-	4	-	4	-	-	-	25*	--	25	50

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid-term and second skill test at the end of the term.

Rationale:

A Mechanical Engineer, irrespective of their field of operation in an industry, is expected to possess a thorough understanding of drawing, which includes clear visualization of objects and the proficiency in reading and interpreting a wide variety of production drawings. Besides, they are also expected to possess certain degree of drafting skills depending upon job function, to perform day to day activity i.e. communicating and discussing ideas with supervisors and passing on instructions to subordinates unambiguously.

In the engineering world, CAD is revolutionized modern day engineering and widely used to design and develop products to be used by consumers. CAD allows for the easier development of products and product management integration. CAD drawings offer the flexibility to draft and design in a digital sphere, which were previously done by hand. The digital format makes data handling easier, safer, and quicker. Prior hand drawn blueprints can be scanned and then can be expanded upon digitally. Many CAD programs are now using three-dimensional drawings to maximize productivity and provide quicker, better product results, allowing for the development of the tiniest details. CAD's excellent ability for comprehensive documentation and communication allows for an easier product management environment.

Course Outcomes: Student should be able to

CO1	Apply appropriate limits, fits, tolerances & surface finish on drawing.
CO2	Use standard conventions of mechanical elements as per SP-46(1988).
CO3	Interpret & Draw production drawings of components/parts for a given assembly.
CO4	Visualize details of components and draw assembly of components.
CO5	Draw 2-D drawings, assembly drawings using layers, and Print/Publish the drawings.
CO6	Create Isometric, 3-D drawings of mechanical components & Print /Publish the drawings

Course Content Details:

Unit No	Topics / Sub-topics
1	**Limits, Fits and Tolerances** 1.1 Introduction to ISO system of tolerancing, dimensional tolerances, elements of interchangeable system, hole & shaft basis system, limits, fits & allowances. Selection of fit. (Simple Numerical) 1.2 Geometrical tolerances, tolerances of form and position and its geometric representation. 1.3 Characteristics of surface roughness - Indication of machining symbol showing direction of lay, roughness grades, machining allowances, manufacturing methods. **Course Outcome: CO1**
2	**Production Drawing Basics** 2.1 Conventional Representations using SP – 46 (1988) 2.1.1 Materials C.I., M.S, Brass, Bronze, Aluminum, wood, Glass, Concrete and Rubber 2.1.2 Long and short break in pipe, rod and shaft. 2.1.3 Ball and Roller bearing, pipe joints, cocks, valves, internal / external threads. 2.1.4 Various sections- Half, removed, revolved, offset, partial and aligned sections. 2.1.5 Knurling, serrated shafts, splined shafts, and chain wheels. 2.1.6 Springs with square and flat ends, Gears, sprocket wheel 2.1.7 Countersunk & counter bore. 2.1.8 Tapers 2.2 **Welded Joints:** Representation of the following weld & preparing working drawing showing the size of weld, weld length, flush finish etc. Fillet 2.2.1 Square butt 2.2.2 Single and double U 2.2.3 Single and double V 2.2.4 Single and double J 2.2.5 Bevel butt 2.2.6 Edge / seam / bead 2.2.7 Spot weld 2.2.8 All round weld 2.2.9 Flush finish weld **Course Outcome: CO2**
3	**Introduction to Computer Aided Drafting**: 3.1 Various Software's for Computer Aided Drafting. 3.2 CAD initial settings commands. 3.3 Object Selection methods **Course Outcome: CO3**
4	**Basic Commands in CAD** 4.1 Zoom and formatting Commands: 4.1.1 Zoom Commands – all, previous, out, in, extent, realtime, dynamic, window, pan. 4.1.2 Formatting commands - Layers, block, linetype, lineweight, color. 4.2 Draw and Enquiry commands: 4.2.1 Draw Command - Line, arc, circle, rectangle, polygon, ellipse, point, spline, block, hatch etc. 4.2.2 Enquiry commands - distance, area, volume, and list command. 4.3 Edit and Modify commands: 4.3.1 Modify Command - Erase, break, trim, copy, move, mirror, offset, fillet, chamfer, array, extend, rotate, scale, lengthen, stretch, measure, divide, explode, align, join, spline edit Commands. 4.4 Dimensioning, Text and Plot Commands: 4.4.1 Dimensioning commands - Dimension styles, Dimensional Tolerances and Geometrical

	Tolerances, ddedit. 4.4.2 Text commands – Text style, dtext, mtext command. 4.4.3 Plotting & Publishing a drawing – creating standard template, title block, creating table, Bill plot Commands. 4.5 Drawing the given Sketches & Production Drawing of machine components. **Course Outcome: CO4**
5	**Assembly drawing** 5.1 Assembly to Details: Introduction – basic principles of dismantling process. Preparation of detailed working drawing from given assembly, indicating proper type of fit & tolerance relevant to that fit and the grade of surface finish required. The drawing to be self-explanatory for manufacturing of the components. The objects may be selected from the following & not containing more than 8 parts: 5.1.1 Lathe Tail Stock 5.1.2 Jigs & Fixtures 5.1.3 Piston & connecting rod assembly 5.1.4 Gland and Stuffing box Assembly 5.1.5 Valves: Steam Stop Valve & Non – Return Valve 5.1.6 Fast & loose pulley 5.2 Details to Assembly: Preparation of the assembly drawings from the given detailed drawings of the parts of machine unit. Objects may be selected from the following & not containing more than 8 parts. 5.2.1 Couplings – Universal couplings & Oldham's Coupling 5.2.2 Bearing – Foot Step Bearing & Pedestal Bearing 5.2.3 Lathe tool Post, Tail stock 5.2.4 Machine vice & Pipe Vice 5.2.5 Screw Jack 5.2.6 Jigs and Fixtures 5.2.7 Valves: Steam stop valves & Non Return Valves, **Course Outcome: CO5**
6	**Isometric and 3D Drawings:** 6.1 Drawing of Isometric Views from orthographic views of objects using CAD. 6.2 Drawing of 3D (pictorial) objects from the Two/Three views of the objects using CAD. **Course Outcome: CO6**

List of experiments:

Sr. No.	Unit No	COs	Title of the Experiments	Hrs
1	3	CO1	Assignment on Limit, Fit, Tolerances and Machining Symbols in sketch book	02
2	4	CO2	Assignment on Conventional Representation as per SP – 46 (1988) in sketch book	02
3	4	CO2	Assignment on welded joints in sketch book	02
4	4	CO3	Assignment on Redraw Figures & Isometric View in sketch book (Minimum 4 problems each)	02
5	1	CO3	Assignment on Assembly to Details in sketch book (Minimum 2 problems)	06
6	2	CO4	Assignment on Details to Assembly in sketch book (Minimum 2 problems)	06
7	2	CO3	Generation of production drawings of the machine parts and assembly with appropriate tolerances using layer, blocks & dimensions in CAD.	08

Sr. No.	Unit No	COs	Title of the Experiments	Hrs
8	3	CO5	Draw Assembly of machine components with layer, blocks & dimensions in CAD. (Minimum 2 problems).	08
9	4	CO5	Draw Detail of assembly of machine components with layer, blocks & dimensions in CAD. (Minimum 2 problems).	08
10	5	CO6	Draw Isometric drawing in CAD. (Minimum 08 objects)	08
11	4	CO6	Draw 3D drawings in CAD. (Minimum 06 objects),	08
			Total	**60**

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Machine Drawing	N. D. Bhatt, Charotar Publishing House, 50th edition, 2016	978-9385-0392-32
2	Production Drawing	L. K. Narayanan, P. Kannaich, K. Venkat Reddy, New Age International Publication, 3rd edition, 2006	978-8122-4251-85
3	Machine Drawing	N Sidheswar, P Kannaiah &V V S Sastry, Tata McGraw Hill Education Pvt. Ltd., 2010	978-0074-6033-76
4	Machine Drawing	N. D.Junnarkar, Pearson, 2006.	978-8131-7067-87
5	IS Code SP 46 (2003)	Code of practice for general engineering drawing, Engineering Drawing Practice for School and colleges, Bureau of Indian Standards, 9 Bahadur Shah Zafar Marg, New Delhi 110002	81-7061-019-2
6	AutoCAD: A Problem-Solving Approach	Sham Tickoo, Delmar Cengage Learning (31 January 1998)	978-0766-8012-95
7	Machine Drawing with AutoCAD	Gautam Purohit & Gautam Ghosh, Pearson Publication	978-1299-4461-82
8	Mastering AutoCAD and AutoCAD LT 2018	George Omura, BPB Publication	978-1119-3867-97

E-References:

1. http://www.we-r-here.com/cad/tutorials/index.htm
2. http://www.cadtutor.net/tutorials/autocad/
3. http://www.caddprimer.com/AutoCAD_training_tutorial/AutoCAD_training_lessons.htm
4. http://www.autocadmark.com/
5. http://www.autocadtutorials.net/
6. www.youtube.com
7. EKHO Institute presents Professional AutoCAD Training Videos

8. Learning AutoCAD 2012 Tutorial DVD – Publisher – Infinite Skills Inc.
   Email : directsales@infiniteskills.com

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	3	3	2	2	3	3	2
CO2	3	2	3	3	2	2	3	3	2
CO3	3	2	3	3	2	2	3	3	2
CO4	3	2	2	2	2	2	3	3	2
CO5	3	2	3	3	2	2	3	3	2
CO6	3	2	3	3	2	2	3	3	2

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Coordinator,
Curriculum Development,
Department of Mechanical Engineering _

Head of Department
Department of Mechanical Engineering

I/C, Curriculum Development Cell

Principal

Programme: **Diploma in Mechanical Engineering (Sandwich Pattern)**										
Course Code: ME19R207				Course Title: Fluid Mechanics and Machinery						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
2	**2**	**--**	**4**	**60**	**20**	**20**	**--**	--	**25**	**125**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill test are to be conducted. First skill test at midterm and second skill test at the end of the term

Rationale:

Hydraulic machines have important role in water supply, irrigation, power generation and in most of the engineering segments. Knowledge of fluid properties, fluid flow and fluid machinery is essential in all fields of engineering. This course is intended to develop the skills to estimate loss in pipes, efficiency of hydraulic machines like turbines, pump etc., head on a pump and select a pump for a particular application. Diagnose and rectify the faults in pumps and turbines, replace the pressure gauges and other accessories on hydraulic machines and apply their knowledge in hydraulics to select appropriate devices like pressure gauge, valves, flow devices, pipes etc. for different field applications.

Course Outcomes: Student should be able to

CO1	Use manometers and Bourdon gauge to measure pressure.
CO2	Use flow meters to measure the rate of flow.
CO3	Analyze flow through pipes.
CO4	Analyze impact of jet on various types of vanes for optimum efficiency.
CO5	Analyze performance of hydraulic turbine
CO6	Analyze performance of hydraulic pump

Course Content Details:

Unit No	Topics / Sub-topics
1	**Properties of Fluid and Fluid Pressure** **1.1.** Properties of Fluid: Density, Specific Gravity, Specific volume, Dynamic Viscosity, Kinematic viscosity, Surface tension, Capillarity, Vapor pressure, Compressibility. **1.2.** Fluid Pressure and Pressure Measurement: Fluid pressure, Pressure head, Pressure intensity, Concept of absolute vacuum, Gauge pressure, Atmospheric pressure, Absolute pressure, Simple and differential manometers, Bourdon's tube pressure gauge. Total pressure, Center of pressure (Horizontal, Vertical, Inclined surfaces). **Course Outcome: CO1 Teaching Hours: 05 Marks: 08 (R- 02, U-04, A-02)**

2	**Fluid Flow.** **2.1.** Types of fluid flow: Laminar, Turbulent, Steady, Unsteady, Uniform, Non uniform, Rotational, Irrotational, One, Two, Three dimensional. **2.2.** Continuity equation. Bernoulli's Theorem **2.3.** Venturimeter – Construction, Principle of working, Coefficient of discharge, Derivation of discharge through Venturimeter. **2.4.** Orifice meter - Construction, Principle of working, Hydraulic coefficients for orifice, Derivation for discharge through orifice meter **2.5.** Pitot tube- Construction, Principle of working. **Course Outcome: CO2 Teaching Hours: 05 Marks: 10 (R-02, U- 04, A-04)**
3	**Flows Through Pipes.** **3.1.** Laws of fluid friction. Darcy's equation & Chezy's equation for loss of head due to friction. **3.2.** Minor losses in pipe fittings and valves **3.3.** Hydraulic gradient line and Total energy line. **3.4.** Hydraulic power transmission through pipes **3.5.** Water hammer phenomenon in pipes, causes and remedial action **Course Outcome: CO3 Teaching Hours: 04 Marks: 10(R-02, U- 04, A-04)**
4	**Impact of Jets** **4.1.** Impact of jet on fixed Vertical, moving Vertical flat plates. **4.2.** Impact of jet on curved Vanes. **Course Outcome: CO4 Teaching Hours: 03 Marks: 06 (R-00, U- 02, A-04)**
5	**Hydraulic Turbines** **5.1.** Layout & features of hydroelectric power plant. **5.2.** Classification of hydraulic turbines. **5.3.** Construction & working principle of Pelton wheel Turbine, Francis Turbine, Kaplan Turbine. **5.4.** Draft tubes- types and construction, Concept of cavitations in turbine **5.5.** Calculation of work done & power efficiency of turbine. **Course Outcome: CO5 Teaching Hours: 07 Marks: 13(R-04, U- 06, A-03)**
6	**Hydraulic Pumps** **6.1.** Centrifugal pumps: Construction, Principle of working, Methods of priming & Cavitation. Types of casing & impellers. Manometric head, Work done, manometric efficiency, mechanical efficiency, Overall efficiency. Velocity diagrams, NPSH. Priming and its importance. **6.2.** Reciprocating pumps: Construction, working principles & applications of single & double acting reciprocating pumps, Concept of slip, negative slip. Cavitation and separation. Use of air vessel. Criteria for pump selection **Course Outcome: CO6 Teaching Hours: 06 Marks: 13(R-04, U-06, A- 03)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Fluid pressure & its measurement	02	04	02	08
2	Fluid flow	02	04	04	10
3	Flows through pipes	02	04	04	10
4	Impact of jets	-	02	04	06
5	Hydraulic turbines	04	06	03	13
6	Hydraulic pump	04	06	03	13
	Total	**14**	**26**	**20**	**60**

List of experiments:

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Use Bourdons pressure gauge and U tube manometer to measure water pressure and discharge of water using measuring tank and stop watch.	02
2	2	CO2	Verification of Bernoulli's theorem	04
3	2	CO2	Use Venturimeter to measure discharge through a pipe.	02
4	2	CO2	Determination of coefficient of discharge for flow through orifice.	02
5	3	CO3	Determine Darcy's friction factor 'f' in pipes of different diameters.	02
6	3	CO3	Determine frictional losses in sudden expansion, sudden contraction, bend and elbow in pipes	04
7	4	CO4	Assignment on impact of jet	02
8	5	CO5	Determine overall efficiency of Pelton Wheel	04
9	5	CO5	Trial on Francis turbine to determine overall efficiency.	04
10	6	CO6	Determine overall efficiency of Centrifugal Pump	02
11	6	CO6	Determine overall efficiency of Reciprocating Pump.	02
		Total		**30**

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Hydraulics and Fluid Mechanics including Hydraulic Machines	Modi P. N. Seth S. M. Standard Book House New Delhi, 22nd Ed., 2013	978-8189-4012-69
2	Fluid Mechanics and Hydraulic Machine	Bansal R. K. Laxmi Publication Pvt. Ltd. New Delhi, 22nd Ed., 2018	978-8131-8081-53
3	A textbook of Fluid Mechanics and Hydraulic Machines	Rajput R. K. S Chand and Company Pvt. Ltd. New Delhi, 6th Ed., 2016	978-9385-4013-74
4	Fluid Mechanics and Hydraulic Machines problems and solution	Subramanya K. Tata McGraw Hill Co Ltd New Delhi, 4th Ed., 2011	978-0070-6998-09
5	Introduction to Fluid Mechanics and Fluid Machines	Som S. K. Biswas G Tata McGraw Hill Co Ltd New Delhi, 3rd Ed., 2005	978-0071-3291-94
6	A textbook of Hydraulics, Fluid Mechanics and Hydraulic Machines	Khurmi R. S. S Chand and Company Pvt. Ltd. New Delhi, 9th Ed., 2015	978-8121-9016-28
7	Hydraulics, Fluid Mechanics and Hydraulic Machines	Ramamrutham S. Dhanpat Rai and Sons New Delhi, 9th Ed., 2011	978-9384-3782-71
8	Hydraulic Machines	Jagdish Lal Metropolitan 3rd Ed., 2008	978-8120-0042-21

E-References:

1. **www.nptel.ac.in/courses**
2. **www.learnerstv.com**
3. **www.ni.com/multisim**

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	3	2	2	2	2	3	3	2
CO2	2	3	3	3	2	2	3	2	2
CO3	3	2	3	2	2	2	3	2	2
CO4	2	3	2	2	2	2	2	3	2
CO5	3	3	2	3	2	2	3	3	2
CO6	2	3	3	3	2	2	2	3	2

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Curriculum Development, Department of Mechanical Engineering

Department of Mechanical Engineering

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