GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

MANUFACTURING ENGINEERING - I
(Code: 3331901)

Diploma Programme in which this course is offered	Semester in which offered
Mechanical Engineering	3rd Semester

1. RATIONALE

This subject of Manufacturing Engineering provides knowledge regarding different types of manufacturing processes used to produce variety of metal products used in automobile and other machines and equipment. It also develops understanding that can be used to suggest and manipulate vital process parameters related to different manufacturing processes so that the high quality component may be produced at low cost and in minimum time, this is important if we want to compete in today's global market. It also provides information about behavior of metal and change in it during different manufacturing process.
As a technician the knowledge and practical skills in different manufacturing processes are essential and hence emphasis is also given in this course towards skills development. Further the technician should be able to handle machine, equipment, tools and accessories in the recommended manner and also follow safety precautions.

This subject is divided in two courses i.e. Manufacturing Engineering –I and Manufacturing Engineering-II. This course of Manufacturing-I deals with some of the above contents.

2. COMPETENCY (Programme Outcome as per NBA Terminology)

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency.

- **Produce the job as per given specification by selecting and applying appropriate manufacturing processes like Casting, Forming, Joining, using optimum process parameters and safe working procedures.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	0	4	7	70	30	40	60	200

Legends: L -Lecture; **T** -Tutorial/Teacher Guided Student Activity; **P** -Practical; **C** - Credit; **ESE**-End Semester Examination; **PA** -Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA Terminology)	Topics and Sub-topics
Unit – I Introduction to manufacturing processes	1.a Explain the basic manufacturing processes. 1.b Describe various mechanical properties involved.	1.1 Nature, role and scope of manufacturing processes. 1.2 Role of machining, forming, casting and joining processes in manufacturing of industrial components. 1.3 Recall mechanical properties of material.
Unit – II Metal working processes	2.a Compare the principles of hot and cold working Process. 2.b Identify and explain various metal working processes. 2.c Suggest appropriate metal working process and basic parameters for a given industrial component.	2.1 Concept, principles and differences of hot and cold working processes. 2.2 Classification of forming processes. 2.3 Rolling, Forging, Spinning, Drawing, Extrusion, Swaging. i. Types. ii. Working principle. iii. Equipments used and their specifications. iv. Major parts of equipments and their construction of materials and functions. v. Process parameters. vi. Applications.
Unit – III Metal casting processes	3.a Appreciate the need of casting process. 3.b Calculate pattern allowances. 3.c Interpret the standard color coding on pattern as well as core. 3.d Suggest appropriate casting method suitable for a given industrial component. 3.e Identify casting defects, their causes and suggest remedies.	3.1 Basic concept of foundry process. 3.2 Types of foundries. 3.3 Pattern: i. Importance. ii. Types and materials of construction. iii. Allowances, their need and normal values. iv. Drawings and color codes. v. Making process. vi. Applications. 3.4 Cores: i. Need. ii. Types. iii. Making materials and its properties. iv. Testing methods. v. Sintering. vi. Applications. 3.5 Types, working and applications of furnaces. 3.6 Molding sand: i. Sand properties. ii. Sand mixing. iii. Sand binders.

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA Terminology)	Topics and Sub-topics
		3.7 Molding equipments, their major specifications and applications. 3.8 Types of mould, mould making, mould sintering and applications of mould. 3.9 Salvage techniques. 3.10 Recovery of sand. 3.11 Casting processes: basic principle, working, process parameters and applications. i. Centrifugal. ii. Die. iii. Investment. iv. Shell molding. 3.12 Casting defects -types, causes, effects and remedies. 3.13 Safety precautions in foundry.
Unit – IV **Non metal moulding processes**	4.a Suggest appropriate moulding method suitable for a given non metal industrial component.	4.1 Concept, basic principle, major parts, working and their materials of construction, process parameters and applications of: i. Injection moulding. ii. Blow moulding. iii. Extrusion process. 4.2 Safety precautions.
Unit – V **Metal joining processes**	5.a Appreciate the need of joining process to reduce cost and time. 5.b Explain different welding processes. 5.c Identify the area of applications of a particular joining process. 5.d Suggest appropriate process and process parameters based on given joining situation. 5.e Practice standard safety norms during any joining process.	5.1 Introduction and classification. 5.2 Welding: working principle, setup sketch, specifications of equipment and consumables, functions of each element, process parameters for various materials, applications and safety precautions for: i. Gas welding (Oxy-acetylene, Air-acetylene, oxy-hydrogen and LPG (Liquid Petroleum Gas)- oxygen. ii. Arc welding (Carbon arc, metal arc, MIG (Metal Inert Gas), TIG (Tungsten Inert Gas), flux coated arc and submerged arc). iii. Resistance welding (butt, spot, seam, projection and percussion). iv. Thermit welding. v. Forged welding. 5.3 Welding defects -types, causes, effects and remedies. 5.4 Working principle, setup sketch, specifications of equipment, tools and consumables, functions of each element, process parameters for various materials, applications and safety precautions for:

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA Terminology)	Topics and Sub-topics
		i. Soldering. ii. Brazing. 5.5 Adhesive joining - process, applications. 5.6 Fastening process - process, applications.

5 SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to manufacturing processes.	03	03	02	00	05
II	Metal working processes.	12	05	07	08	20
III	Metal casting processes.	12	05	07	08	20
IV	Non metal moulding processes.	03	02	03	00	05
V	Metal Joining Processes.	12	05	07	08	20
Total		**42**	**20**	**26**	**24**	**70**

Notes:

a. This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

b. If midsem test is part of continuous evaluation, unit numbers I, II (2.1 and 2.2-only rolling, forging and spinning), III (Up to 3.6) and IV are to be considered. It is also compulsory for student to complete experiment.no.1 to 6 to eligible for midsem test.

c. Ask the questions from each topic as per marks weightage. Numerical questions are to be asked only if it is specified. Optional questions must be asked from the same topic.

6. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills **(Course Outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies (Programme outcomes). Following is the list of practical exercises for guidance.

Note: Here only course outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those programme outcomes/course outcomes related to affective domain.

S. No.	Unit Number	Practical/Exercise (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Hours
1	II	Prepare two jobs using hot forging/hot smithy process. This includes cutting of raw material and preparation of pre forged parts.	06
2	II	Demonstration of spinning process with preparation of a job.	04
3	II	Visit a nearby Rolling mill/Hot-Cold material processes, allied manufacturing processes industry and prepare a two page report comprises of details(type, material, process, etc) of items produced, quantities, different sections, equipments used with specification, process parameters being used and consumables.	--
4	III	Demonstration of metal melting, metal pouring, metal casting and casting finishing. Also demonstrate and prepare a report on casting defects. (Use wax in place of molten metal for the purpose of demonstration.)	04
5	III	Prepare a pattern drawing, pattern and core from the given component/drawing.	06
6	III	Prepare a mould using prepared pattern, core and moulding sand. Also pour molten metal and get the casting.	06
7	III	Visit a nearby foundry and prepare a two page report comprises of details (type, material, process, etc) of items produced, quantities, different sections, equipments used with specification, process parameters being used and consumables.	--
8	IV	Prepare at least two jobs containing minimum 4 parts in each using arc welding. This includes cutting of raw material and preparation of pre-weld parts and use tacks and continuous welding in each job.	08
9	IV	Prepare at least two jobs using gas cutting and gas welding. This includes cutting of raw material and preparation of pre-weld parts. Minimum 3 parts for each job should be taken and should include tacks and continuous welding.	06
10	IV	Prepare a job using spot/seam resistance welding. This also includes cutting of raw material and preparation of pre-weld parts.	04
11	IV	Prepare two jobs, one using soldering and another using brazing. This also includes cutting of raw material and preparation of pre weld parts.	06
12	IV	Visit a nearby fabrication industry and prepare a two page report comprises of types of item produced, quantities, different sections, equipments used with specification and consumables.	--
13	ALL	SCHOOL WITHIN SCHOOL: Each student will present and will prepare report on: a. His/her observation for the jobs made. b. His/her experience during industrial visits. c. Process parameters and their effects.	06
		TOTAL	**56**

Notes:

a. It is compulsory to prepare log book of exercises. It is also required to get each exercise recorded in logbook, checked and duly dated signed by teacher.
b. Student activities are compulsory and are also required to be performed and noted in logbook.
c. Term work report must not include any photocopy/ies, printed manual/pages, litho, etc. It must be hand written / hand drawn by student only.
d. Term work report content of each experience should also include following.
    i. Experience description / data and objectives.
    ii. Drawing of experience / setup with labels/nomenclature to carry out the experience.
    iii. The specifications of machines / equipments / devices / tools /instruments /items/elements which is / are used to carry out and to check experience.
    iv. Process parameters / setup settings' values applied to carry out experience.
    v. Steps / Process description to execute experience.
e. For 40 marks ESE, students are to be assessed for competencies achieved. They should be given following tasks(minimum two):
    ii. Prepare pattern drawing and pattern from given component/component drawing.
    iii. Prepare weld joint job from given drawing.
    iv. Prepare job from given drawing using gas welding/gas cutting.
    v. Prepare job from given drawing using any one resistance welding method.
    vi. Competency based questions and answers.

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Sr. No.	Activity.
1	Select four industrial components (approved by teacher) and list various methods of manufacturing used to produce these components.
2	Select at least two components which are made by casting only. Also state the type of casting method used.
3	Prepare a list of household items which are prepared by joining processes.
4	Prepare a list of plastic items which are produced using different types of molding methods. Also name the process used.
5	Prepare a list of industries/workshops in the nearby area which are producing components by machining, casting and forming.
6	Identify the type of manufacturing process used in making main component of a car engine.

8. SPECIAL INSTRUCTIONAL STRATEGIES (If ANY)

Sr. No.	Unit	Unit Title	Strategies
1	I	Introduction to manufacturing processes.	Share the experience. Show various movies.
2	II	Metal working processes.	Demonstration. Movies. Live examples with suitable components. Industrial visits. Show effect of process parameters.
3	III	Metal casting processes.	
4	IV	Non metal casting processes.	
5	V	Metal Joining Processes.	

9. SUGGESTED LEARNING RESOURCES

(A) List of Books:

Sr no.	Title of Books	Author	Publication
1.	Workshop Technology I & II	J. A. Schey	Tata MacGraw Hill Education
2.	Workshop Technology I & II	Raghuwanshi	Dhanpat Rai and Sons
3.	Workshop Technology I, II & III	W. A. J. Chapman	Arnold
4.	Manufacturing Processes	M. L. Begman	Wiley India
5.	Production Technology	R.K. Jain and S.C. Gupta	Khanna publication
6.	Welding Engineering	B.E. Rossi	Jefferson Publications
7.	Audles Welding Guide	F.D. Graham	Wiley India
8.	Foundry Engineering	P.L. Jain	Tata MacGraw Hill Education
9.	Principle of Foundry	Jain & Gupta	National Book Trust, India
10.	Manufacturing Processes	S.E. Rusinoft	Times of India Press
11.	Production Technology	H.H. Marshall	Machinery Publishing Company

(B) List of Software/Learning Websites:

a: www.youtube.com/watch?v=k6iODHla6qY
b: http://web.iitd.ac.in/~pmpandey/MEL120_html/Metal%20Forming%20Processes.pdf
c: http://thelibraryofmanufacturing.com/forming_basics.html
d: http://www3.nd.edu/~manufact/MPEM%20pdf_files/Ch07.pdf
e: www.ielm.ust.hk/dfaculty/ajay/courses/ieem215/lecs/3_forming.pdf
f: www.youtube.com/watch?v=HkjdMdp9KVU
g: http://www-old.me.gatech.edu/jonathan.colton/me4210/casting.pdf
h: http://www.mccannsales.com/book/sandcasting.pdf
i: http://me.emu.edu.tr/me364/2.pdf
j: http://www.ielm.ust.hk/dfaculty/ajay/courses/ieem215/lecs/8_joining.pdf
k: http://www.tech.plym.ac.uk/sme/mats116/Materialsjoiningprocesseslecturenotes_docx.pdf
l: http://www.aws.org/w/a/
m: www.youtube.com/watch?v=H3Qb9I03FCk
n: www.youtube.com/watch?v=JqFp5kCeTA0

o: www.youtube.com/watch?v=7F0ypF6IdrU
p: http://www.flamingfurnace.com/
q: http://www.sme.org
r: http://www.youtube.com/watch?v=IrcNSgLZuFs (Metal Casting)
s: http://www.youtube.com/watch?v=Yk1JOYzwRP4 (Loose piece Pattern)
t: http://www.youtube.com/watch?v=khEvhjlh_SM (Foundry Pattern making)
u: http://www.youtube.com/watch?v=f7FXtnXVqzY (Aluminium Casting)
v: http://www.youtube.com/watch?v=dOw624I9FDQ (Investment Casting)
w: http://www.youtube.com/watch?v=bzSSfBgkWfc&NR=1&feature=endscreen (Hot Chamber Die Casting Process)
x: http://www.youtube.com/watch?v=Ul00-KoC1Oc (Shell Moulding)
y: http://www.youtube.com/watch?v=pTTap4WiEAU (Gravity Die Casting)
z: http://www.youtube.com/watch?v=eUthHS3MTdA (Plastic Injection Moulding)
aa: http://www.youtube.com/watch?v=6xnKmt_gsLs (Hot Rolling)
bb: http://www.youtube.com/watch?v=9MU0vSN_w-A (Cold roll forming)
cc: http://www.youtube.com/user/IGEJohannesen?feature=watch (Channel For welding videos)
dd: http://www.youtube.com/watch?v=SDJdiNeDXto (Introduction to Welding)
ee: http://www.youtube.com/watch?v=CJ42scaWFnw (Brazing video)

(C) List of equipments:

a. Pattern Making:
   i. Wood cutting planer machine/Wood jack plane
   ii. Carpentry vice
   iii. Flat file
   iv. Hammer
   v. Steel rule
   vi. Right angle
   vii. Saw
b. Molding
   i. Cope and drag Boxes
   ii. Molding sand with additives and binder
   iii. Vent wire
   iv. Furnace or Oven
   v. Consumable (Wax)
c. Smith forging
   i. Anvil
   ii. Furnace
   iii. Hammer
   iv. Tong
   v. Steel rule
   vi. Air blower
   vii. Swage block
d. Spot/Resistance welding
   i. Spot welding machine
   ii. Plier cutter
   iii. Hammer
   iv. Steel rule

v. Anvil

e. Arc welding
   i. Arc welding Machine with electrode holder
   ii. Tong
   iii. Chipping hammer
   iv. Wire brush
   v. Hand gloves
   vi. Hand screen
   vii. Safety goggles

f. Gas welding
   i. Oxy acetylene gas cylinders with regulators
   ii. Welding torch
   iii. Tong
   iv. Chipping Hammer
   v. Steel rule
   vi. Hand gloves
   vii. Safety goggles

g. Gas Cutting
   i. Oxy acetylene gas cylinders
   ii. Cutting torch
   iii. Tong
   iv. Steel rule

h. Brazing
   i. Brazing torch
   ii. Consumables
   iii. Tong
   iv. Hammer
   v. Anvil
   vi. Wire brush

i. Spinning
   i. Hand shearing Machine/ cutter Plier
   ii. Hammer
   iii. Steel rule
   iv. Lathe Machine
   v. Spinning tool

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. M. M. Jikar**, HOD, Department of Mechanical Engineering, N. G. Patel Polytechnic, Bardoli.
- **Prof. M. K. Patel**, Lecturer, Department of Mechanical Engineering, M. L. Institute of Diploma Studies, Bhandu.

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. S.K.Pradhan**, Associate Professor and Head Department of Mechanical Engineering
- **Dr. Vandana Somkuwar** Associate Professor, Department of Mechanical Engineering

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

THERMODYNAMICS
(Code: 3331902)

Diploma Programme in which this course is offered	Semester in which offered
Mechanical Engineering	3rd Semester

1. RATIONALE

Thermodynamics is a science of energy transfer and its effect on physical properties of substances. It is based upon observations of common experiences of energy (mainly heat) transfer. Thermodynamic laws have been formulated based on these experiences. In this course, work and heat transfer with changes in associated properties is studied based on laws of thermodynamics. This course will provide an understanding of the basic principles of thermodynamics which is must for understanding of major fields of mechanical engineering and technology notably in steam and nuclear power plants, internal combustion engines, gas turbines, air conditioning, refrigeration, gas dynamics, jet propulsion, compressors and energy conversion in different devices.

2. COMPETENCY (Programme Outcome according to NBA Terminology):

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency

- **Apply basic concepts, laws and principles of thermodynamics to use and select equipments/devices/machines working on these basics.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	0	0	3	70	30*	00	00	100

Legends: L -Lecture; **T** -Tutorial/Teacher Guided Student Activity; **P** -Practical; **C** - Credit; **ESE**-End Semester Examination; **PA** -Progressive Assessment.

* 30 marks of Theory PA include two assignments each of 5 marks. First assignment must have total 12 numerical from Unit number I,II and III. Second assignment must be of 10 numerical from Unit number IV and V and report on student activities performed. Each numerical of each assignment must have different parameters for each student, that is each student will get total 22 numerical with same problem but with varied parameters. (Values of temperature, pressure, volume, etc may be different for each student.).

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I **Basic concepts of thermodynamics**	1.a Identify a thermodynamic property and use it with appropriate units. 1.b Explain Zeroth law of thermodynamics.	1.1 Introduction. 1.2 Thermodynamic systems-concept, terminology associated, classification, concept of continuum. 1.3 Thermodynamics properties & their units. 1.4 Concept of energy, heat, work and power- types & simple numerical examples. 1.5 Zeroth law of thermodynamics and its application. 1.6 Name of various Temperature measurement devices/instruments used with related units.
Unit – II **First law of thermodynamics**	2.a Explain first law of thermodynamics. 2.b Apply first law of thermodynamics to real life situations.	2.1 Joule's experiment-set up & significance. 2.2 Law of conservation of energy. 2.3 First law of thermodynamics with reference to: i. Closed system. ii. System undergoing a change of state. iii. Open system. 2.4 Energy equation & its application to: i. Non flow process. ii. Open system. iii. Steady flow (Steady flow energy equation –SFEE) 2.5 Limitations of first law of thermodynamics. 2.6 Simple numerical examples based on above.
Unit – III **Ideal gases and thermodynamic processes**	3.a Explain various ideal gas laws & thermodynamic processes. 3.b Calculate amount of heat transfer, work transfer & internal energy associated with the process.	3.1 Various ideal gas laws. 3.2 Characteristic gas equation and Universal gas constant. 3.3 Specific heats & their relationship. 3.4 Different thermodynamic processes, their representation on P-V (Pressure-Volume) and T-s (Temperature-Entropy) diagram. 3.5 Equations for PVT relationship, work transfer, heat transfer internal energy (without derivations).

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
		3.6 Simple numerical examples based on above.
Unit – IV Second law of thermodynamics	4.a Describe second law of Thermodynamics. 4.b Apply second law of thermodynamics in real life problems. 4.c Appreciate importance of entropy.	4.1 Concept and real life examples of heat source, heat sink (reservoir), heat engine, heat pump and refrigerator. 4.2 Second law of thermodynamics. i. Kelvin-Plank statement ii. Clausius statement. iii. Equivalence of above two statements. iv. Corollary. 4.3 Concept of thermal efficiency and COP (Coefficient of Performance). 4.4 Concept, importance and examples of entropy. 4.5 Concept of reversibility and irreversibility of thermodynamic processes causes of irreversibility. 4.6 Carnot cycle, representation on P-V, T-s diagrams, derivation, examples.
Unit – V Thermodynamic cycles	5a. Identify thermodynamic processes in a cycle. 5b. Plot various cycles on property diagram 5c. Derive expression for efficiency. 5d. Solve simple examples of power producing cycle.	5.1 Concept of air standard efficiency. 5.2 Otto, Diesel & Dual Combustion cycle : i. Representation on P-V & T-s diagram, derivation for air standard efficiency & simple examples. ii. Limitations, applications & comparison of above cycles based on different parameters. 5.3 Refrigeration cycles: Reversed Carnot cycle, Reversed Brayton cycle: i. Representation on P-V & T-s diagram & expression for COP (without derivation).

5. SUGGESTED SPECIFICATIONTABLE WITH HOURS & MARKS(THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basic concepts of thermodynamics	06	04	03	03	10
II	First law of thermodynamics	06	03	03	04	10
III	Ideal gases and processes	10	04	06	06	16
IV	Second law of thermodynamics	10	04	07	05	16
V	Thermodynamic cycles	10	04	06	08	18
Total		**42**	**19**	**25**	**26**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Notes:

1. This specification table shall be treated as a general guideline for students and Teachers. The actual distribution of marks in the question paper may slightly vary from above Table.
2. If midsem test is part of continuous evaluation, unit numbers I, II and unit III up to 3.4 are to be considered.
3. Ask the questions from each topic as per marks weightage. Numerical questions are to be asked only if it is specified. Optional questions must be asked from the same topic.

6. SUGGESTED LIST OF PRACTICAL/EXERCISES

Not Applicable

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Sr. No.	Activity.
1	Identify and list real situations which works on: a: Zeroth law. b: First law of thermodynamics. c: Second law of thermodynamics.
2	Prepare charts of diesel, duel and gasoline cycles. Tabulate main points of differences between them.
3	Write the specifications of domestic refrigerator available at your home and I.C.Engine of any two wheelers. Also draw & explain cycle on which domestic refrigerator and I.C.Engine works.
4	Prepare chart of p-v & p-h diagram for refrigeration cycle.
5	Prepare chart for different thermodynamics process with the help of p-v, t-s, h-s diagram.

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

Sr. No.	Unit	Unit Title	Strategies
1	I	Basic concepts of thermodynamics.	Real life examples. Demonstration of real systems. Movies/Animations. Numerical.
2	II	First law of thermodynamics.	
3	III	Ideal gases and processes.	
4	IV	Second law of thermodynamics.	
5	V	Thermodynamic cycles.	

9. SUGGESTED LEARNING RESOURCES

(A) List of Books:

Sr. No.	Title of Books	Author	Publication
1.	Thermodynamics	R. Yadav	CPH
2.	Thermodynamics for Engineers	M.L. Mathur	Dhanpatrai & sons
3.	Heat Engines	C.S. Shah & N.C. Pandya	Charotar Publi. House
4.	Elements of Heat Engines Vol. I&II	R.C. Patel &	Acharya Book Depot
6.	Thermodynamics	SAAD	Prentice-Hall
7.	Engineering Thermodynamics- 2nd edition	P. K. Nag	McGraw Hill Education
8.	Applied Thermodynamics	R.C. Patel	Acharya Book Depot
9.	Thermodynamics	Gupta	Pearson

(B) List of Software/Learning Websites:

a. http://www.nptel.iitm.ac.in/video.php?subjectId=112105123(IIT-B Vidéo lectures)
b. http://www.thermofluids.net/
c. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv301-Page1.htm
d. http://www.grc.nasa.gov/WWW/k-12/airplane/thermo.html
e. http://www.youtube.com/watch?v=Xb05CaG7TsQ
f. http://www.youtube.com/watch?v=aAfBSJObd6Y
g. http://www.youtube.com/watch?v=DHUwFuHuCdw
h. http://www.youtube.com/watch?v=kJlmRT4E6R0
i. http://www.youtube.com/watch?v=GKqG6n6nAmg

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. S. R. Pareek**, Head of Department, Mechanical Engineering Department, Tolani F. G. Polytechnic, Adipur.
- **Prof. D. M. Trivedi**, Lecture in Mechanical Engineering, K.J. Polytechnic, Baruch.
- **Prof. Shah Atul S**., Lecturer in Mechanical Engineering, Government Polytechnic, Waghai.
- **Prof. M. N. Patel**, Lecturer in Mechanical Engineering, Government Polytechnic, Chhota Udepur.

Coordinator and Faculty Members from NITTTR Bhopal:

- **Prof. Sharad Pradhan**, Associate Professor and Head Department of Mechanical Engineering,
- **Dr. Vandana Somkuwar** Associate Professor, Department of Mechanical Engineering

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

FLUID MECHANICS AND HYDRAULIC MACHINES
(Code: 3331903)

Diploma Programmes in which this course is offered	Semester in which offered
Mechanical Engineering	3rd Semester

1. RATIONALE

The main objective of this course is to understand the fundamentals of the fluid mechanics such as fluid and flow properties, fluid behaviour at rest and in motion and fundamental equations like mass, energy and momentum conservation of the fluid flow thereby developing an understanding of fluid dynamics in variety of fields. Applications of these basic equations have been highlighted for flow measurements. Hydraulic machinery plays an important role in the conversion of hydraulic energy to mechanical energy and vice-versa. Hydraulic turbines are used for meeting our day-to-day power demands. Also different types of pumps are essential equipment in all the industries. It is also tried to develop an understating of hydraulic & pneumatic devices generally used in industries through this course. Hydraulic systems have a wide range of applications in machine tools, material handling, marine, mining, metal processing, equipment and other fields. Similarly pneumatic control is extensively used as an effective method of automation technique.

2. COMPETENCY (Programme Outcome according to NBA Terminology)

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency.

- **Select, operate and maintain fluid machinery based on fluid laws and characteristics**.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
4	0	2	6	70	30	20	30	150

Legends: L -Lecture; **T -**Tutorial/Teacher Guided Student Activity; **P -**Practical; **C -** Credit; **ESE**-End Semester Examination; **PA** -Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I **Fluid and fluid properties**	1.a Explain the effect of fluid properties on a flow system.	1.1 Concept and classification of fluid. 1.2 Properties of fluid 1.3 Newton's law viscosity. 1.4 Simple numerical examples.
Unit – II **Fluid statics**	2.a Select and use pressure measuring devices.	2.1 Laws of fluid statics. 2.2 Types, working and applications of pressure measuring devices (Manometers and mechanical gauges) with simple numerical examples. 2.3 Selection criteria for pressure measuring devices.
Unit – III **Fluid kinematics**	3.a Identify type of fluid flow patterns. 3.b Describe and use Continuity equitation to one dimensional fluid flow situations.	3.1 Concept of control volume. 3.2 Fluid flow i. Continuity and energy equation. ii. Momentum equations (without derivation) and its application in impact of jet.(The detail applications should be dealt in Unit VII.) iii. Types of fluid flow. iv. Flow patterns for ideal, laminar, turbulent and compressible fluid flow of one dimension. 3.3 Simple numerical problems on all of above.
Unit – IV **Fluid dynamics and flow measurement**	4.a Explain and Apply Fluid equations (Energy, Momentum and Bernoulli's) in simple Industrial situations. 4.b Select and use flow measuring devices based on given situation.	4.1 Fluid energy-types and interrelations. 4.2 Euler's equation. i. Concept and definition. ii. Understanding various terms in Euler's equation (No derivation). 4.3 Bernoulli's equation. i. Concept and definition. ii. Limitations and assumptions. iii. Derivation from Euler's

		equation. iv. Applications. 4.4 Flow measurement. i. Parameters and units of measurements related to following devices. ii. Devices- classifications, principle, working, applications without derivation. (Pitot tube, Venturi meter, Flow nozzle, Rota meter, Orifice, Notch). 4.5 Selection criteria for flow measuring device. 4.6 Simple numerical examples on all of above.
Unit – V **Flow through pipes**	5.a Explain water hammer and surge tank 5.b Select pipe of appropriate size based on given situation.	5.1 Introduction to pipe and pipe flow. 5.2 Reynolds's experiment, friction factor, Darcy's equation, Moody's chart. 5.3 Water hammer effect. 5.4 Selection criteria for pipes and pipe sizes. 5.5 Simple numerical examples.
Unit – VI **Hydraulic pumps & prime movers**	6.a Select and use an appropriate pump with reference to given application. 6.b Estimate performance parameters of a given Centrifugal and Reciprocating Pump. 6.c Interpret characteristic curves of a given pump. 6.d Select an appropriate turbine with reference to given situation.	**Pumps:** 6.1 Concept and classification of pumps. 6.2 Detailed study(construction, working and applications) of i. Centrifugal pump. ii. Reciprocating pump. iii. Submersible pump. iv. Rotary positive displacement type pumps like Gear pump and Van pump. v. Vacuum pump. 6.3 Performance (efficiency, discharge, head, specific speed and power consumption) of centrifugal pump and reciprocating pump with simple numerical example. 6.4 Characteristic curves of centrifugal pump and reciprocating pump. 6.5 Need for priming of centrifugal pump. 6.6 Selection of pumps. **Hydraulic prime movers (Turbine).** 6.7 Classification, construction, working principle and applications

		of: i. Pelton wheel. ii. Francis turbine. iii. Kaplan turbine. 6.8 Selection criteria of prime movers.
Unit – VII **Hydro pneumatic elements and devices**	7.a Select and use proper hydro-pneumatic devices/equipments.	7.1 Types, sketch, working, specifications, symbols and applications of hydraulic and pneumatic elements like: i. Cylinder. ii. Valve. iii. Manifolds, etc. 7.2 Hydraulic devices- i. Hydraulic press. ii. Hydraulic accumulator. iii. Hydraulic lift iv. Hydraulic ram v. Hydraulic crane vi. Hydraulic coupling vii. Hydraulic intensifier. (Explain working of each with labelled schematic diagram, their specifications and Applications)

5. SPECIFICATIONTABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fluid and fluid properties	04	2	2	2	06
II	Fluid statics	07	2	3	4	9
III	Fluid kinematics	07	2	3	4	9
IV	Fluid dynamics and flow measurement	10	4	4	4	12
V	Flow through pipes	06	2	4	2	08
VI	Hydraulic pumps & prime movers	12	2	6	6	14
VII	Hydro pneumatics elements and devices	10	2	4	6	12
Total		**56**	**16**	**26**	**28**	**70**

Notes:

a. This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

b. If midsem test is part of continuous evaluation, unit numbers I, II, IV (Up to 4.3 only), and V are to be considered. It is also compulsory for student to complete exercises.no.1 to 5 to eligible for midsem test.
c. Ask the questions from each topic as per marks weightage. Numerical questions are to be asked only if it is specified. Optional questions must be asked from the same topic.

6. LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills **(Course Outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only course outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those programme outcomes/course outcomes related to affective domain.

S. No.	Unit No.	Practical/Exercises (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx. Hrs. Required
1	I	Demonstrate various fluid properties.	2
2	II	Demonstrate and Measure pressure using: i. Various manometers. ii. Various Pressure gauges.	4
3	IV	Verify Bernoulli's theorem.	2
4	IV	Measure fluid flow by Venturimeter and Nozzle.	4
5	IV	Measure fluid flow by Orifice meter and "V" notch.	4
6	III & V	Estimate Reynolds number using given test rig.	2
7	V	Determine major and minor head loss through pipes.	2
8	VI	Perform testing of centrifugal pump as per BIS.	2
9	VI	Perform testing of reciprocating pump as per BIS.	2
10	VII	Demonstrate use of different hydraulic and pneumatic devices.	2
11	ALL	A group of 5-6 students will take any one hydraulic/ pneumatic device for study/repair purpose. They will : a: Study the same and will prepare required sketches. b: Explain working. c: Identify faults if not working. d: Repair minor faults. (This exercise has to be identified and given to the students in the beginning of term.).	2
		Total	**28**

Notes:

a. It is compulsory to prepare log book of exercises. It is also required to get each exercise recorded in logbook, checked and duly dated signed by teacher.
b. Student activities are compulsory and are also required to be performed and noted in logbook.
c. Term work report must not include any photocopy/ies, printed manual/pages, lithos, etc. It must be hand written / hand drawn by student only.
d. Term work report content of each Exercise should also include following.
    1. Exercise description / data and objectives.
    2. Drawing of Exercise / setup with labels/nomenclature to carry out the Exercise.
    3. The specifications of machines / equipments / devices / tools /instruments /items/elements which are / are used to carry out and to check Exercise.
    4. Process parameters / setup settings' values applied to carry out Exercise.
    5. Steps / Process description to execute Exercise.
    6. Information on recent machines / equipments / devices / tools /instruments /items available in market to carry out the Exercise.
    7. Special / Additional notes or remarks.
e. For 20 marks ESE, students are to be assessed for competencies achieved. They should be given :
    i. any one set of exercise/practical to be performed, and
    ii. Competency based questions and answers.

7. SUGGESTED LIST OF STUDENT ACTIVITIES

1	Prepare a tabulated summary for types of fluid which is available around you. (Summary includes properties of fluid indicated in chapter-1)
2	List out any five pressure measuring devices available in market with its specifications and current market price.
3.	Prepare a tabulated summary for types of pipes available in market. (Summary includes type, specification, size range, material, rate and applications).
4	Identify any one hydraulic pump and one prime mover available in market in a group of five students with detail specifications and current price.
5	Visit a nearby related industry and prepare a summary of hydro-pneumatic devices used along with their specifications.

8. SPECIAL INSTRUCTIONAL STRATEGIES (If any)

Sr. No.	Unit	Strategies
1	I	Demonstration with fluids.
2	II	Video movies.
3	III	Video movies.
4	IV	Video movies.
5	V	Demonstration with pipes.
6	VI	Live models/actual equipments to be used.
7	VII	Live models/actual equipments to be used.

9. SUGGESTED LEARNING RESOURCES

(A) List of Books:

S. No.	Title of Books	Author	Publication
1	Fluid mechanics& hydraulic Machines.	R.K.Bansal	Lakhsmi publication
2	Fluid mechanics& hydraulic Machines. (in S.I. units)	R.S.Khurmi	S.chand & Co.Ltd
3	Hydraulic & Hydraulic machines	R.C. Patel & A.D. Pandya	Acharya Book Depot
4	Fluid mechanics& hydraulic	A.R. Basu	DHANPAT RAI&
5	Fundamental of fluid mechanics(in S.I. units)	Dr. D.S. Kumar	Ketson Pub. house
6	Fluid mechanics& hydraulic machines	S.C. Gupta	PERSON Education
7	Hydraulic Machines & Fluidics	Dr. Jagdishlal book co.	Metropolitan
8	Industrial Pneumatic control	Z.J. Lansky	Marcel Dekker, Inc

(B) List of major equipment/materials:

a. Different manometers.
b. Pitot tube.
c. Various mechanical pressure gauges.
d. Hydraulic test rig-comprising facilities to verify Bernoulli's theorem , to measure fluid flow by Venturimeter ; nozzle; orifice meter , rota meter, "V" notch and major and minor head loss through pipes.
e. Centrifugal pump test rig.
f. Reciprocating pump test rig.
g. Hydraulic prime movers (Pelton wheel) test rig.
h. Working model of Francis turbine and Kaplan turbine.
i. Working models and charts of hydraulic devices.
j. Reynolds's experiment test rig.
k. Vacuum pump.
l. Gear pump.
m. Submersible pump.
n. Hydraulic and pneumatic elements like cylinders, valves, manifold, distributors, etc.(All major types).
o. Hydraulic power pack.

(C) List of Software/Learning Websites, concerned subject:

a. www.youtube.com/watch?v=VyR8aeioQrU
b. http://www.youtube.com/watch?v=R6_q5gxf4vs
c. howstuffworks.com
d. http://www.elearningsofttech.com/elearning-solutions-subjects-engineering-degree-diploma-courses/hydraulics-fluid-mechanics/
e. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/FLUID-MECHANICS/ui/TOC.htm
f. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/machine/ui/TOC.htm
g. https://www.youtube.com/watch?v=F_7OhKUYV5c&list=PLE17B519F3ACF9376
h. https://www.youtube.com/watch?v=zOJ6gWDMTfE&list=PLC242EBB626D5FFB5
i. http://www.youtube.com/watch?v=0p03UTgpnDU
j. http://www.youtube.com/watch?v=A3ormYVZMXE
k. http://www.youtube.com/watch?v=TjzKpke0nSU
l. http://www.youtube.com/watch?v=vl7GteLxgdQ
m. http://www.youtube.com/watch?v=cIdMNOysMGI

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. H.R. Sapramer,** Lecturer in Mechanical Engineering, Dr. J.N. Mehta Government Polytechnic, Amreli
- **Prof. M.P. Jakhaniya,** Lecturer in Mechanical Engineering, C.U. Shah Government Polytechnic, Surendranagar.
- **Prof. V.P. Patel,** Lecturer in Mechanical Engineering, N.M. Gopani Polytechnic, Ranpur
- **Prof. H.K. Patel,** Lecturer in Mechanical Engineering, Vallabh Budhi Polytechnic, Navsari.

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. Sharad Pradhan**, Associate Professor and Head Department of Mechanical Engineering
- **Dr. C.K. Chugh,** Professor, Department of Electronic Media

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: Strength of Material (Code: 3331904)

Diploma Programme in which this course is offered	Semester in which offered
Mechanical/ Mechatronics	THIRD

1. RATIONALE

We have already studied the external effects due to action of force system in Applied Mechanics in Second Semester. All Mechanical Engineering Components are subjected to different loadings and behave in a specific way. In this course , analysis of determinate structures / components under action of transverse loading , along with , analysis of members under direct and lateral along with shear loading & torsion is analysed. This course will lay sound foundation to analysis & design of Machine Components.

2. COMPETENCY

1. Understand the behaviour and analyse Statically Determinate structure like beam , Column & Shaft under static loads & twisting moments
2. Calculate the machine material properties & dimension of machine component due to direct & lateral loading and due to deflection.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
03	00	02	05	70	30	20	30	**150**

Legends: L - Lecture; **T -** Tutorial/Teacher Guided Student Activity; **P -** Practical; **C -** Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I **DIRECT STRESS & STRAIN**	1a. Evaluate Material Properties Under Longitudinal , Lateral Loads & Thermal variation 1b. Analyse Composite & Compound Section for stress& strain. 1c. Compute Strain Energy under Different Types of Loading on elements.	1.1 Different types of Structures and Loads 1.2 Direct Stress , linear Strain , Hook's Law Calculate Numerical on Direct Stress & Linear Strain , Stress Strain curve of Mild Steel , Modulus of Elasticity ,Yield , Breaking & Ultimate Stress and factor of Safety 1.3 Lateral Strain and Poission's ratio 1.4 Temperature Stresses & Strain with & without yielding 1.5 Shear Stress , Shear Strain & Shear Modulus 1.6 Bulk Modulus & Volumetric Strain 1.7 Differentiate Sudden , Gradual & Impact Load Strain Energy & Proof Resilience for Sudden , Gradual & Impact Load with numerical problems
Unit – II **MOMENT OF INERTIA**	2 Compute Moment of Inertia of Symmetric & asymmetric structural sections	2.1 Moment of Inertia & its Importance 2.2 Parallel & Perpendicular Axis Theorem 2.3 Formula of Moment of Inertia of solid & Hollow sections like Rectangle , Triangle , Circle 2.4 Moment of Inertia about C.G for I section , H section , Channel Section , Angle Section , T Section and Built up Section having flange plates to I & H Section and of Double Channels back to back & toe to toe
Unit – III **S.F & B.M IN BEAM**	3 D raw Shear Force & Bending Moment Diagram for Statically Determinate Beams	3.1 Statically Determinate Beams Like Cantilever , Simply Supported & Over Hang Beam 3.2 Relation between Shear Force and Bending Moment 3.3 Sagging & Hogging Bending Moment and its importance 3.4 Point of Contra flexure & its importance 3.5 S.F & B.M Diagram for Cantilever , Simply Supported & Over Hang Beam elements like shaft , axle , spindle subjected to Point Load and/ or U.D.L
Unit – IV **BENDING STRESSES IN BEAM**	4 Use ' Theory of Bending' to compute stresses in Beams	4.1 Bending Theory Equation Bending stress , Sectional Modulus , Nutral Axis Application of Bending theory to Statically determinate beams elements like shaft , axle , spindle , pulley arm having

Unit	Major Learning Outcomes	Topics and Sub-topics
		rectangular or circular section to find out stresses
Unit – V **DEFLECTION OF BEAMS**	5 Determine deflection induced in Statically Determinate Beams	5.1 Slope & Deflection 5.2 Formulae for Cantilever Beam subjected to Point Load at free end and with full UDL 5.3 Formulae for S.S Beam subjected to Point Load at MID SPAN and with full UDL 5.4 Numerical problems on Slope and Deflection for 5.2 & 5.3
Unit – VI **COLUMNS & STRUTS**	6 Calculate Load carrying capacity of Column & Strut	6.1 Column & Strut 6.2 Short & Long Column 6.3 End Condition of Column and effective Length of Column & Modes of Failure in column 6.4 Radius of Gyration , Slenderness Ratio 6.5 Euler's Crippling Load & its numerical 6.6 Rankin's load / Buckling Load of Column / screw of screw jack & its numerical
Unit – VII **COMBINED DIRECT & BENDING STRESSES**	7 Analyse Structural components subjected to Axial Eccentric Loads	7.1 Eccentricity 7.2 Formula for combined Direct & Bending Stresses 7.3 Limit of Eccentricity 7.4 Core section for Rectangular & Circular (Hollow & Solid) 7.5 Numerical on Combined Stresses for Rectangle & Circular Section
Unit – VIII **PRINCIPAL PLANE & PRINCIPAL STRESS**	8. Calculate Principal Stresses on a plane in a Strained structural Material	8.1 Formulae for Normal , Tangential & Resultant Stresses due to Direct Orthogonal Stresses & Shear Stress 8.2 Numericals on Principal Plane & Principal Stress 8.3 Formulae for Principal Stresses and for Location of Principal Planes 8.4 Numerical based on 8.3
Unit – IX **TORSION**	9a. Analyse Machine Components subjected to Torsion for torsional stress 9b. Calculate Power Transmitted by Shaft , spindle and axle subjected to Torsion	9.1 Torsion , Angle of Twist , Polar Moment of Inertia , Torsional Rigidity 9.2 Formula of Torsional Stress 9.3 Formula for Power Transmitted / Consumed for shaft , spindle and axle of solid and hollow sections subjected to Torsion 9.4 Numericals based on 9.2 & 9.3
Unit – X **MECHANICAL PROPERTIES OF MATERIALS**	10a. Identify various materials used in Mechanical Engineering 10b. Evaluate Mechanical Properties of Materials used	10.1 Various Mechanical Engineering Materials 10.2 Specifications of materials in accordance to BIS , ASME 10.3 Test Mechanical Properties like HARDNESS , IMPACT

Unit	Major Learning Outcomes	Topics and Sub-topics
		10.4 Compare materials with their utility point of view

6 SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**DIRECT STRESS & STRAIN**	08	02	04	08	14
II	**MOMENT OF INERTIA**	04	01	00	04	05
III	**S.F & B.M IN BEAM**	05	02	00	08	10
IV	**BENDING & SHEAR STRESSES IN BEAM**	05	04	00	06	10
V	**DEFLECTION OF BEAM**	04	00	00	04	04
VI	**COLUMN & STRUT**	03	00	00	04	04
VII	**COMBINED DIRECT & BENDING STRESSES**	04	01	06	00	07
VIII	**PRINCIPAL PLANE & PRINCIPAL STRESS**	04	02	05	00	07
IX	**TORSION**	03	01	00	04	05
X	**MECHANICAL PROPERTIES OF MATERIALS**	02	00	04	00	04
Total		**42**	**13**	**19**	**38**	**70**

7 SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire the competency. Following is the list of experiments for guidance.

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
1	I	Draw Stress Strain Curve for Tension Test on Ductile Materials like Mild Steel , Aluminium	04
2	I	Determine Young's Modulus of wire of Given Material	02

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
3	II	Calculate Moment of Inertia of Fly Wheel	02
4	VI	Demonstrate End Conditions of Column	02
5	X	Calculate Impact Value of Mild Steel using IZOD Impact Test Apparatus	02
6	X	Calculate Impact Value of Mild Steel using Charpy Impact Test	02
7	X	Calculate Brinell Hardness Number of given material	02
8	X	Calculate Hardness of given material using Rockwell Hardness machine	02
9	X	Find out Compressive Strength of C.I , M.S using Compression Testing Machine	02
10	I	Calculate at least Six Problems of Unit - I	02
11	III	Calculate at least Six Problems of Unit – III	02
12	VII	Calculate at least Six Problems of Unit VII	02
13	VIII	Calculate at least Six Problems of Unit VIII	02
		TOTAL	**28**

8 SUGGESTED LIST OF STUDENT ACTIVITIES

1. Market Survey specific to properties of Various type of Materials used in Mechanical Engineering
2. Student will prepare file based on practical

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

S. No.	Title of Books	Author	Publication
1.	Strength of Material & Mechanics of Structures	Dr. B C Punamia	
2.	Strength of Material	S RAMAMURTHAN	
3.	Strength of Material	TimoShanku	
4.	Theory of Structures	R S KHURMI	

B. List of Major Equipment/Materials

1. Universal Testing Machine

2. SEARL'S Apparatus to find Young's Modulus

3. Working Model of End Conditions of Column

4. IZOD Impact Test Apparatus

5. CHARPY Test Apparatus

6. FLY WHEEL

7. Compression Testing Machine

8. Brinell Hardness Testing Machine

9. Rockwell Hardness Testing Machine

C List of Software/Learning Websites

1. nptel.iitm.ac.in/courses/.../IIT.../lecture%2023%20and%2024.htm
2. en.wikipedia.org/wiki/Shear_and_moment_diagram
3. www.freestudy.co.uk/mech%20prin%20h2/stress.pdf
4. www.engineerstudent.co.uk/stress_and_strain.html
5. https://www.iit.edu/arc/workshops/pdfs/Moment_Inertia.pdf

9. INSTRUCTIONAL STRATEGICS:

Teachers can prepare or download ppt of different topic's Mechanical engineering application , can prepare alternative slides.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

1. PROF. B G RAJGOR , H.O.D , APP. MECH. , BBIT , V V NAGAR
2. PROF. K VENKATESHWARLU , H.O.D , APP. MECH. , TFG POLYTECHNIC , ADIPUR
3. PROF. J H GABRA , I/C H.O.D , APP. MECH. , G.P , GODHARA
4. PROF D R KATARIYA , LME , G.P , BHUJ

Coordinator and Faculty Members from NITTTR Bhopal

1. Dr. A K JAIN , PROFESSOR , DEPARTMENT OF CIVIL & ENVIORNMENT ENGINEERING

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

APPLIED ELECTRICAL AND ELECTRONICS.
(Code: 3331905)

Diploma Programmes in which this course is offered	Semester in which offered
Mechanical, Metallurgy, and Mining Engineering	3rd Semester

1. RATIONALE

Electrical and electronics engineering equipment is widely used in mechanical/ metallurgy/mining engineering applications and a diploma engineer from any of these disciplines have to identify the related equipment being used in the industry with respect to their working and major faults that could occur**.** Majority of mechanical/metallurgy/mining industries are of small and medium scale where electrical engineers are not recruited. For normal electrical and electronics tasks, shop floor mechanical /metallurgy/mining diploma engineer needs to attend the situation. If electrical personnel are to be called to electrical/electronic related issues, some basic reasons are primarily required to be known by them. Therefore, this course will help the student to acquire the requisite knowledge and skills.

2. COMPETENCIES (Programme Outcomes as per NBA Terminology)

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competencies

- **Identify the major parts of electrical and electronic equipment being used in mechanical/metallurgy/mining engineering applications with respect to their working and major faults that could occur.**
- **Use electrical and electronic elements/systems to actuate simple mechanical mechanism.**
- **Attend normal electrical faults and use electrical tools and instruments for normal applications effectively.**

3. TEACHING AND EXAMINATION SCHEME.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	ExaminationScheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	0	2	5	70	30	20	30	**150**

Legends: L -Lecture; **T** -Tutorial/Teacher Guided Student Activity; **P** -Practical; **C** - Credit;**ESE**-End Semester Examination; **PA** -Progressive Assessment.

4. COURSE DETAILS.

Unit	MajorLearning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Fundamentals of electrical engineering and magnetic circuit	1a. Define the terms associated with magnetic circuits. 1b. Compare between right hand rule and cork screw rule.	1.1 Electricity generation-principle, working setup, elements and their functions. 1.2 Concept of AC (Alternating Current) and DC (Direct current). 1.3 Magnetic circuit: M.M.F, magnetic force, magnetic field strength, permeability, reluctance, magnetic flux, hysteresis loop. 1.4 Magnetic field of permanent magnet and current carrying conductor, Right hand rule and Cork Screw rule.
	1c. Define the terms: Electromotive force, current, voltage, resistance, and conductance. 1d. Define the parameters associated with AC supply.	1.5 Terminologyassociated with electrical circuit: Electromotive force, current, voltage, resistance, and conductance. 1.6 Ohm's law. 1.7 AC wave cycle, instantaneous value, amplitude, frequency, time period, R.M.S. value, mean value, phase, phase difference, power factor, electric field, work, power and energy.
	1e. Establish the relationship between line and phase quantities. 1f. Describe the concept of single phase and three phase supply with sketches.	1.8 Concept of line value and phase value,line voltage, line current, phase voltage andphase current. 1.9 Concept of single phase and three phase supply.
Unit – II **Electrical components, tools and instruments**	2a. State the specifications of electrical materials and select the components for simple applications.	2.1. Types, specifications, materials and applications of wires, cables and fuses. 2.2. Types, construction, symbols,materials and applicationsof switches/plugs/sockets.
	2b. Use electrical tools and instruments for simple applications. 2c. Describe with sketches the connection of the various types of meters and CRO to measure the various parameters.	2.3. Types, specifications, materials of construction and applications of various tools. 2.4. Meters: multimeter,clip-on, meter, tester, voltmeter, ammeter, energy meter, CRO- Types, specifications, materials of construction, connection method and applications.
Unit – III Electrical Machines	3a. Explain the working of single phase transformer with	3.1 Transformer Types: Core and shell type, auto transformers.

Unit	MajorLearning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
	schematic line diagrams. 3b. Describe the construction of core and shell type transformer with sketches. 3c. Explain the working of autotransformer with sketches. 3d. State the line and phase values for star and delta connections of transformers.	3.2 Construction and working of transformer, transformation ratio. 3.3 Comparison between conventional and auto transformer. 3.4 Three phase supply connections - Star and Delta connection-diagrams/circuit, applications.
	3e. Explain the working of a DC machine. 3f. Justify the need for starter in DC machines.	3.5 DC machines:construction, working and applications, necessity of starter. 3.6 DC and AC generators-construction, working and applications.
	3g. Explain the working of synchronous machines. 3h. Describe the working of a three phase induction motors. 3i. Describe the working of a single phase induction motors. 3j. List the common faults occurring in AC motors.	3.1 Synchronous machines:construction andworking 3.2 Types of AC motors: Three phase and single phase- specification, construction, working, starting method, connection diagrams and applications. 3.3 Commonly occurring faults in single phase motor, three phase motor.
	3k. Describe the working of stepper motor with line diagrams 3l. Describe the working of servo motor with line diagram.	3.4 Fractional Horse power motors - construction, working,number of inputs, number of outputs and how to connect, common troubles and remedies: i. Stepper motor ii. Servo motors.
Unit – IV Electrical Safety and Protection	4a. Check the effectiveness of earth connections of any electrical installation. 4b. Check the insulation resistance of electrical installations.	4.1 Earthing. 4.2 Insulation.
	4c. List the different types of protective devices along with their symbols used in equipment and installations. 4d. Describe the working of optical fibres from opto-isolation point of view.	4.3 Safety and Protection-specification, working and applications of protective devices such as fuses, MCBs and ELCBs. 4.4 Concept of optical fibre communication. 4.5 Opto-isolation for circuit safety.
Unit – V Electronic Components and Circuits	5a. Specify values of different discrete electronic devices along with their symbols.	5.1 Discrete electronic components: Symbols, general construction and working: Resistor, Inductor, Capacitor, Diode, Transistor, photo diodes.

Unit	MajorLearning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
	5b. State the need for microcontrollers and PLCs used with various equipments.	5.2 Microcontrollers and PLCs (Programmable Logic Controller) - Concept, general constructional features, working and applications.
	5c. Interpret the circuit diagrams consisting of regulated power supply and different types of rectifiers	5.3 Regulated power supply, Rectifier (Half and Full wave), Uninterruptible power supply (UPS) -
	5d. Interpret the circuit diagrams consisting of different types of power electronic devices such as DIAC, TRIAC, SCR, IGBT, GTOs	5.4 Power electronic components: Symbols, general construction and working: DIAC, TRIAC, SCR, IGBT and GTO.
	5e. Use PCBs for simple applications.	5.5 PCB-concept and general applications. 5.6 PCBs for following applications: i. Movement of stepper motor according to input value of x, y and z coordinates. ii. Generate different time delay by 555 timers IC. iii. A circuit which latch the given input (Switch 1) and reset by another input (Switch 2). iv. Circuit to detect a given object. (Use photo diode and photo transistor).

5. SUGGESTED SPECIFICATIONTABLE WITH HOURS & MARKS(THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Fundamentals of electrical engineering and magnetic circuit.	08	06	06	02	14
II	Electrical components, tools and instruments	10	04	04	08	16
III	Electrical machines, drives and transformers	12	08	06	06	20
IV	Electrical safety and protection	04	00	02	04	06
V	Electronic components and circuits	08	06	04	04	14
		42	**24**	**24**	**22**	**70**

Legends:R = Remember; U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

Note:

a: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

b: If midsem test is part of continuous evaluation, unit numbers I, II (Up to 2.2), IV and V(only 5.1) are to be considered. It is also compulsory for student to complete experiment.no.1 to 5 to eligible for midsem test.

c: Ask the questions from each topic as per marks weightage. Numerical questions are to be asked only if it is specified. Optional questions must be asked from the same topic.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises shouldbeproperly designed and implemented with an attempt to develop different types of practical skills **(Course Outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only course outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those programme outcomes/course outcomes related to affective domain.

S. No.	UnitNo.	Practical/Exercise(Course Outcomes in Psychomotor Domain according to NBA terminology)	Apprx. Hrs. Required
1	**I**	a: Demonstrate generation of electricity and explain various terminologies associated with it. b: Demonstrate difference between AC and DC. c: Verify Ohm's law.	04
2	**I**	Perform any one from following. a: Obtain the required voltages across the branches in the given network. b: Obtain the required incoming current at different nodes of the given network.	02
3	**II**	Do electrical wiring for given case/parameters using electrical wires/cables, components and tools. Test the same and measure applicable parameters/variables like resistance, current, power, voltage, power factor, etc. Also do following. a: Identify the cables and fuses along with their specifications. b: Identify and state specifications of various meterstaken in use.	04
4	**III**	Perform following.(Any two, but preferably all). a: Connect the single phase electric motor to start them (using the circuit diagram). b: Connect the three phase electric motor to start them (using the circuit diagram).. c: Connect the DC motors to start them. (using the circuit diagram).	02
5	**III**	Perform any one from following.(Do both if possible). a: Connect the synchronous machine to run as a generator. (using the circuit diagram). b: Connect the synchronous machine to run as a motor.	02
6	**III**	Identify the faults in the given electric motor.	02
7	**III**	a: Operate the given stepper motors for the given speeds. (using the circuit diagram). b: Operate the given servo motors for the given speeds. (using the circuit diagram).	02
8	**IV**	a: Use the earth tester and megger for the given installation. b: Select the most appropriate protective device for the given application. c: Use fuse, MCBs and ELCBs for attending repair tasks.	04
9	**V**	Use PCB for simple applications.	04
10	**V**	Use PLC Or Microcontroller for specific applications.	02
		Total	**28**

NOTES:

a. It is compulsory to prepare log book of exercises. It is also required to get eachexercise recorded in the logbook, checked and duly signed by teacher with date.
b. Term work report must not include any photocopy/ies, printed manual/pages, litho,etc. It must be hand written / hand drawn by student only.
c. For 20 marks ESE, students are to be assessed for practical skills achieved.

7. SUGGESTED LIST OF STUDENT ACTIVITIES:

i. Write the specifications of lamp, CFL bulb, pump motor, fan and blender motor available at your room/house.
ii. Identify few mechanical engineering situations which require automation.
iii. Identify the type of electrical drives used in lathe, milling, grinding, shaper, power hack saw machines of your workshop. Also write their specifications.
iv. Visit nearby workshop, industry, testing lab and prepare a list of machines, instruments which are controlled using PLC and microcontroller.

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any).

Sr. No.	Unit	Unit Title	Strategies
1	**I**	Fundamentals of electrical and magnetic circuits.	Demonstration. Movies.
2	**II**	Electrical components, tools and instruments	Demonstration.
3	**III**	Electrical machines, drives and transformers	Demonstration.Power point presentations, Movies.
4	**IV**	Electrical safety and protection	Real life situations, demonstrations, Movies.
5	**V**	Electronic components, tools and circuits	Real life situations, demonstrations, Movies.

9. SUGGESTED LEARNING RESOURCES

A) List of Books:

Sr.No.	Title of Books	Author	Publication
1.	Basic Electronics &Linear Circuits	Theraja, B.L.	McGraw Hill Education, New Delhi,
2.	A text book of ElectricalTechnology vol.2	Theraja, B.L.	S.Chand Publication, New Delhi 2011 or latest
3.	A Course In ElectricalAnd ElectronicMeasurements AndInstrumentation	Sawhney, A K	S.Chand Publication, New Delhi 2011 or latest
4.	Basic electronics	Mehta ,V.K.	S.Chand Publication, New Delhi 2011 or latest

B) List of Major Equipment/Materials with Broad Specifications

i. DC shunt,series and compound motor – 3 HP 230 V DC , 19 A, 1000 RPM
ii. DC shunt motor-generator set – 3 HP, 230 V DC, 16 A, 1000 RPM,
iii. Three Phase Induction motor-3 HP, 400 V, 50 Hz, 1500 RPM,
iv. Three Phase Synchronous Machine-3 HP 400 V, 50 Hz, 1500 RPM,
v. Single phase transformer – 230 V / 115 V, 1 kVA 1-phase transformer
vi. Auto transformer : 0 – 230 V, 10 Amp
vii. Welding transformer: 50 V, 50 /100 Amp

C) List of Software/Learning Websites

i. www.nptel.com/iitm/

ii. www.howstuffworks.com/

iii. www.vlab.com

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE.

Faculty Members from Polytechnics

- **Prof. Pratik Solanki**, Lecturer in Mechatronics, B.S.Patel Polytechnic, Kherva.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. N P Patidar,** Associate Professor, Dept. of Electrical and Electronics Engineering
- **Dr. Joshua Earnest,** Professor, Dept. of Electrical and Electronics Engineering

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

COMPUTER AIDED MACHINE DRAWING
(Code: 3331906)

Diploma Programme in which this course is offered	Semester in which offered
Mechanical Engineering	3rd Semester

1. RATIONALE

The students of mechanical engineering programme are mainly involved in drafting, manufacturing, inspection and planning activities (such as preparing process plans, preparing bill of materials, etc.) in industries. For all such activities, reference document is the drawing of component/assembly to be manufactured. In this context, it is of utmost importance to prepare, read and interpret these drawings correctly for production of components and assemblies accurately and precisely. The industrial practices of drafting are also important for the students to make them aware of drafting practices, symbols, codes, norms and standards generally used in industries.

Development of sketching ability also strengthens effective engineering communication & presentation. Now a days the market driven economy demands frequent changes in product design to suit the customer needs. With the introduction of computers the task of incorporating frequent changes as per requirement is becoming simpler. This course has been introduced at Diploma level in order to develop the skills in student so that they can generate various digital production drawings as required in industry using various CAD software.

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2. COMPETENCY (Programme Outcome according to NBA Terminology)

The course content should be taught and implemented with the aim to develop differen types of skills so that students are able to acquire following competency.

- **Prepare production drawings using computer and relevant software and following standards codes and norms.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	100
0	0	4	04	0	0	40	60	

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** - Practical; **C** - Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Introduction	1.a Interpret drafting, tolerance and geometrical symbols in given production drawings. 1.b Appreciate AutoCAD (Mechanical) environment in context to production drawings.	1.1 Basic knowhow of computer hardware, software and peripherals. 1.2 Concept and need of machine drawings. 1.3 Drafting, tolerance and geometrical symbols used in machine drawing. 1.4 AutoCAD (Mechanical) screen, library, symbols, templates in context of machine drawing. 1.5 Drawing standards.(IS-696 /SP 46) (Drawing/ printing/ storage)
Unit – II 2D production drawings	2.a Prepare and plot 2D production machine drawings using AutoCAD (Mechanical).	2.1 Simple 2D production drawings of 6-7 Mechanical components made up of minimum 5-6 manufacturing operations using Auto CAD (Mechanical). 2.2 2D assembly productions drawing of any one simple mechanical assembly having minimum 5-6 components each made up of 5-10 manufacturing operations using AutoCAD (Mechanical). 2.3 Take print outs of above drawings using Printer/plotter.
Unit – III 2D parametric drawings	4.a Prepare 2D parametric drawings of simple machine components using Pro/E or Solid Edge.	3.1 Concept and examples of parametric and non parametric models. 3.2 Concept, examples and applications of constraints and relations. 3.3 Simple 2D parametric drawings of 6-7 machine components made up of minimum 5-6 manufacturing operations each using sketcher mode.
Unit – IV Project work	4.b Prepare assembly drawing of mechanical components with codes, standards and symbols using AutoCAD (Mechanical)	4.1 Prepare one assembly drawing having 4-5 mechanical components, draw orthographic projections of each component with Institute template and take print out of it. (Group of 5-7 students).

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Not Applicable

6. SUGGESTED LIST OF PRACTICAL/EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (Course Outcomes in psychomotor and affective domain) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only course outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of programme outcomes/course outcomes in affective domain as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those programme outcomes/course outcomes related to affective domain.

Ex. No.	Unit No.	Practical/Exercises (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx. Hrs. Required
1	I	a. Indentify parts of computers. Recall basic knowledge to use computers. Use input devices. b. Prepare a report in tabular form on following. i. All parts of computer, specifications and uses of each part (Namely keyboard, mouse, monitor, processor, RAM, SMPS, Motherboard, etc.)	4
2	II	a. Prepare orthographic production drawings of 6-7 mechanical components (Minimum two should be based on real industrial components selected by student as student activity and approved by teacher) each made up of minimum 5-6 manufacturing operations using AutoCAD (Mechanical). Also take print outs of the same. b. Prepare report on following. i. Select at least two physical mechanical components (approved by teacher). Sketch them with dimensions. ii. Write steps to prepare each drawing using AutoCAD (Mechanical). Steps must include followings. A. Sketch of components at each step with dimensions. B. Sequence of commands with name, options and values. C.	16
3	III	a. Prepare assembly drawing made up of 5-6 mechanical components using AutoCAD (Mechanical) and take print out of it. b. Prepare report on following:	14

Ex. No.	Unit No.	Practical/Exercises (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx. Hrs. Required
		i. Select physical mechanical assembly in group of 5-6 students (approved by teacher). Measure and draw them with dimensions. ii. Write steps to prepare each drawing using AutoCAD (Mechanical).Steps must include followings. A. Sketch of each components and assembly for the same. B. Sequence of commands with name, options and values..	
4	IV	a. Prepare 2D parametric drawings of 6-7 mechanical components (Minimum two should be based on physical components selected by student and approved by teacher as student activity) each made up of minimum 5-6 manufacturing operations using Pro/E (Creo)/Solid Edge. Use constraints and relations also for preparing at least two drawings. Also take print outs of the same. b. Prepare report on following. i. Select at least two mechanical components. (Approved by teacher). Sketch them with dimensions. ii. Write steps to prepare each drawing. Steps must include followings. A. Sketch of components at each step with dimensions. B. Sequence of commands with name, options and values.	08
5	V	a. Prepare given project (as specified in Unit IV) in group of 7-8 students using AutoCAD (Mechanical). Prepare orthographic drawings. b. Identify various parts of given project. c. Prepare report on following: i. Measure dimensions of parts and draw their sketches. ii. Use drawing template and make orthographic assembly drawings.	14
Total Hours			56

Notes:

a. Production drawing include surface roughness values, tolerances, limits, geometrical tolerances/ symbols, heat treatment/ surface treatment notes, etc.
b. It is compulsory to perform students' activities given in table number 7.
c. Submission includes objects, parts/assembly, print outs of drawings prepared, reports and student activities performed. (Term work must not include any photocopy/ies, printed manual/pages (except printouts of drawn

parts/assemblies), litho, etc. It must be hand written/hand drawn (wherever required) by student only.

d. The components and assembly for production drawing must be varied for each student/group (as applicable) in batch so that each student will have different problem.

e. Keep "Westernmann Table" (Revised to Indian Standards, New Age International Publishers) during practice periods.

f. For 40 marks under Practical Marks ESE, students are to be assessed for competencies achieved. Students are to be given data for practical ESE to:

i. Prepare production drawings using AutoCAD and Pro-E software.
ii. Interpret given production drawing/s.
iii. Refer and interpret data from data book/codes/standards/ Westernmann Table.

7. SUGGESTED LIST OF STUDENT ACTIVITIES

SR.NO.	ACTIVITY.
1	Select at least four simple mechanical components each made up of minimum 5-6 manufacturing operations. Get them approved by teacher. Measure and sketch them in report pages with dimensions. (2 to be used for Ex.No.2 and 2 for Ex.No.4).
2	Select at least one simple mechanical assembly in group of 5-6 students, each made up of minimum 5-6 manufacturing operations. Get them approved by teacher. Measure and sketch them in report pages with dimensions. (For Ex.No.3).
3	Bring Actual assembly from workshop/industry, measure dimensions, sketch it and make 2D production drawing for the same.(For Ex.No.5).

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

Sr. No.	Unit	Strategies	
1	I	Introduction	• Show actual desktop and laptop computer system and detail out the functions of each component. • Demonstrate how to connect different parts of a desktop computer and finally its connection with printer. • Demonstrate the procedure of loading the AutoCAD software on a computer system • Give IS Codes of drawing for self study.
2	II	2D Production Drawings	• Bring actual industrial production drawings from nearby industry and distribute them among group of students for self study and interpretation. • Ask students to practice these drawings using AutoCAD software.
3	III	2D Parametric Drawings	• Bring small real components like Nut-Bolt, Washers, Cotter-knuckle Joints, Couplings, Pulleys in the class. • Ask students to use Vernier calliper to measure the dimensions and formulate relations between them.

			• Practice same relations with AutoCAD/Pro-E software to draw 2D/3D models of these component.
4	IV	Project Work	• Take the students for industrial visit. • Hands-on practice with drafting software to create a production drawing of an assembly.

9. SUGGESTED LEARNING RESOURCES

A. List of Books:

Sr. No.	Title of Books	Author	Publication
1	Machine Drawing including AutoCAD	Ajeet Singh	McGraw hill
2	Production Drawing	K L Narayan	New Age Publication
3	Fundamental of Geometric Tolerance and dimensioning	Alex Krulikowski	Cengage Learning
4	Engineering Graphics with AutoCAD	Sarkar .A.K	PHI india
5	Essentials of Engineering Drawing and Graphics using AutoCAD	Jeyapoovan	Vikas publication
6	Pro Engineer Wildfire 5.0 For Engineers And Designers	Sham Tickoo	Dream Tech press
7.	AutoCAD User Guide	Autodesk	Autodesk Press.

B. List of Major Equipment/Materials:

i. CAD Workstation.

ii. 24" colour or mono plotter.

iii. Laser Jet printer.

C. List of Software:

i. Autodesk AutoCAD Mechanical (Educational network licensed latest Version).

ii. Pro/Engineer or Solid edge (Educational network licensed latest Version).

D. Learning Websites.

i. Autodesk Exchange/ AUGI.

ii. PTC university tutorials.

iii. Video tutorials from YouTube and other resources

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. S.H. Sundarani**, Lecturer in Mechanical Engineering, Government Polytechnic, Ahmedabad.
- **Prof. J.B. Patel**, Lecturer in Mechanical Engineering, Sir Bhavsinhji Polytechnic Institute, Bhavnagar.
- **Prof. J.M. Patel,** Lecturer in Mechanical Engineering, B.S. Patel Polytechnic, Kherva.
- **Prof. D.B. Patel,** Lecturer in Mechanical Engineering, Government Polytechnic, Valsad.
- **Prof. T.B. Patel,** Lecturer in Mechanical Engineering, Government Polytechnic, Valsad.

Coordinator and Faculty Members from NITTTR Bhopal

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- **Dr. C.K. Chugh,** Professor, Department of Electronic Media.

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

HUMAN RESOURCE MANAGEMENT
(Code: 3330001)

Diploma Programmes in which this course is offered	Semester in which offered
Bio Medical Engg., Mechanical Engg., Mechatronics Engg., Metallurgy Engg., Power Electronics, Plastic Engg., Printing Technology, Ceramic Engg., Textile Manufacturing Technology, Textile Processing Tech., Textile Designing,	3rd Semester

1. RATIONALE

Human resources are very crucial for effective achievement of changing goals of the organization. They have tremendous level of untapped potential which can be utilised by professional supervisor using human resource management abilities. In changing environment the role of the supervisor and people becomes crucial to success. Working conditions may create stress and conflict which could be managed effectively using various tools and techniques related to training, guidance, counselling, mentoring and coaching. In the present era of globalisation, human resource is considered as a dynamic asset which in turn contributes for achieving the excellence and delighting the customers.

This course aims at developing intra-personal, inter-personal and social competencies in the polytechnic students so as to enable them to perform their future role of supervisor effectively.

2. COMPETENCIES (Programme Outcomes according to NBA Terminology)

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competencies.

i. **Manage people effectively to achieve organizational goals**
ii. **Foster values, positive attitude and interpersonal relations.**
iii. **Facilitate employees for effective achievement of personal goals**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
2	0	0	2	70	30	0	0	100

Legends: L -Lecture; **T** -Tutorial/Teacher Guided Student Activity; **P** -Practical; **C** - Credit; **ESE**-End Semester Examination; **PA** -Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit I **Introduction**	1.a Appreciate importance of human resource	1.1 Need and scope of human resource management in industrial environment. 1.2 Impact of human factors on productivity and industrial harmony. 1.3 Importance of providing need based training to the man power. 1.4 Qualities of a good supervisor.
Unit II **Human needs, relations and values**	2.a Identify human motivations.	2.1 Importance of human resources in Indian philosophy. 2.2 X and Y theory. 2.3 Maslow's hierarchy, its importance in managing human resources.
	2.b Appreciate values and ethics for relationships.	2.4 Need of human relations and human values in the industry, inter department and intra department. 2.5 Good relations with the suppliers and clients. 2.6 Desirable human values and their importance including ethics and morale values.
Unit III **Behavioural dynamics**	3.a Analyse self for interpersonal behaviour.	3.1 Need for interpersonal competence. 3.2 Determinants of interpersonal behaviour. 3.3 Concept of interpersonal orientation and attractions and its importance in human behaviour.
	3.b Develop team spirit and positive attitude.	3.4 Concept of group dynamics. 3.5 Dynamics of group formation. 3.6 Types of groups. 3.7 Role of teams in an organization. 3.8 Desirable characteristics of a team member. 3.9 Concept & importance of positive attitude and openness of mind. 3.10 Do's and don'ts for developing positive attitude. 3.11 Importance of mental health.
Unit IV **Leadership Development**	4.a Use leadership qualities. 4.b Develop subordinates by motivations & training. 4.c Develop decision	4.1 Various definitions of leadership. 4.2 Situational approach to leadership. 4.3 Quality of a good leader. 4.4 Power influence and compliance. 4.5 Influence of Leadership. 4.6 Techniques to deal people effectively. - case studies.

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
	making ability.	4.7 Importance of resource management (human, machine, material, method, money, time (moment), information (message)). 4.8 Need, importance & types of oragnisational training. 4.9 Need and importance of motivations. 4.10 Changing role of supervisor as facilitator& motivator. 4.11 Need, importance and use of guidance, mentoring, coaching and counselling. 4.12 Importance of problem solving and decision making in context of productivity, quality, cost consciousness, human relations and goal achievement. 4.13 Factors affecting decision making. 4.14 Types and process of decision making. 4.15 Make the decisions for given case/situation. - case studies.
Unit V **Change and stress management.**	5.a Identify need for change and barriers to change. 5.b Suggest strategies for any change. 5.c Resolve conflicts.	5.1 Need for change. 5.2 Barriers to change. 5.3 Strategies and tools to manage change.(Effective implementation and management of change). - case studies. 5.4 Trade unions and their objectives. 5.5 Constructive role of trade unions in goal setting, achievement and change management. 5.6 Causes of conflicts and techniques to resolve conflicts - case studies.
	5d. Analyse stress situation 5e. Manage stress.	5.7 Concept of stress. 5.8 Causes of stress. 5.9 Stress measuring techniques. 5.10 Need for relieving stress. 5.11 Techniques to manage the stress- case studies. 5.12 Self-management techniques

5. SUGGESTED SPECIFICATIONTABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction	02	02	03	00	05
II	Human needs, relations and values	04	05	05	00	10
III	Behavioural dynamics	08	06	07	07	20
IV	Leadership Development	08	05	05	10	20
V	Change and stress management	06	02	08	05	15
Total		**28**	**20**	**28**	**22**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6. LIST OF EXERCISES/PRACTICAL

Not Applicable

7. SUGGESTED LIST OF STUDENT ACTIVITIES

a: Name the students with whom you have very good relations. Also list the reasons for that.
b: Name the students with whom you have very bad relations. Also list the reasons for that.
c: List the factors/situations which motivate you.
d: Identify the situations which cause stress to you. Also state reasons for that.
e: Visit institute's canteen, workshop and administration departments and identify the ways how people manage stress during peak hours.
f: Visit nearby hotels, hospitals, malls, workshops, industries and draw the organisational structure followed in these organisations. Also prepare a list of documents that are commonly used by them for effective and smooth working of these organisations.
g: Visit nearby hotels, hospitals, malls, workshops, industries and prepare a report on how they are dealing with day to day grievances and customer complaints.
h: Visit different organisations and prepare a report on various unions exist in these.
i: Each student should search the web and prepare biography of one leader from any field and try to identify the leadership traits he/she possesses.
j: Participate in team building exercises
k: Prepare a plan to develop yourself for achieving excellence

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

Sr. No.	Unit	Strategies	Purpose
1	I	Live examples/movies on productivity and harmony.	Importance of productivity and harmony can be understood.
2	II	a: Group discussion for Maslow's hierarchy. b: Case study/ case movie which appreciate importance of values and ethics.	To identify human motivations and to appreciate values and ethics for relationships.
3	III	a: Presentation on self characteristics. b: Tasks assignments to deal in team. c: Case study/movie. d: Group discussion.	To analyse self for interpersonal behaviour and develop the ability to work in team. Also to develop self confidence and openness of the thoughts.
4	IV	a: Case study-leadership. b: Role play-leadership. c: Group discussion-case for decision making. d: Group discussion for the case which require solution.	To make students aware of the techniques to deal different types of people effectively. Also to develop the ability to identify the factors affecting decision making.
5	V	a: Case study/Movie. b: Group discussion.	To know the causes of conflicts and to find out the resolution techniques of conflicts. Also to know the techniques to manage the stress.

9. SUGGESTED LEARNING RESOURCES

(A) List of Books:

Sr. No.	Title of Books	Author	Publication
1.	Managing people at work.	Ahuja, Jain & Chhabra.	Dhanpatrai and Sons.
2.	Human Resource Management	D.R.Patel, Y.R.Joshi	Atul Prakashan.
3.	Human Resource Management	Biswajeet Pattanayak	PHI
4.	Human Resource Management	K. Aswathappa	Tata McGraw Hill
5.	Human Resource Management	V. S. P. Rao	
6.	Seven Habits of successful people	Stephen R. Covey	Free Press
7.	Competency Framework for HRM	B.L. Gupta	Concept Publishing Company, New Delhi, First Edition 2011
8.	Designing and Managing human resources systems.	Pareek, Udai and Rao T.V.	Oxford and TBH Publishing Co., New Delhi, 1981
9.	Behavioural processes in organisation.	Pareek, Udai and Rao T.V.	Oxford and TBH Publishing Co., New Delhi, 1981

(B) List of Software/Learning Websites:

a. www.cipd.co.uk/NR/rdonlyres/29D9D26D.../9781843982654_sc.pdf
b. www.slideshare.net/kumaravinash23/chapter-12-2634971
c. www.tutor2u.net/business/people/motivation_theory_mcgregor.asp
d. www.mindtools.com
e. kalyan-city.blogspot.com/.../maslow-hierarchy-of-needs-theory-of.html
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10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. Shah Bhaskar K**. Lecturer in Mechanical Engineering, Butler Polytechnic, Vadodara.
- **Prof. A.M. Talsaniya**, Lecturer in Mechanical Engineering, Sir Bhavsinhji polytechnic institute, Bhavnagar.

Coordinator and Faculty Members from NITTTR_Bhopal

- **Dr. B.L.Gupta**, Professor and Head, Department of Management.
- **Prof. Sharad Pradhan**, Associate Professor and Head Department of Mechanical Engineering.