JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., Act. No. 30 of 2008)
ANANTHAPURAMU – 515 002 (A.P) INDIA
Course Structure & Syllabus for B.Tech. (Regular)
R13 Regulations
MECHANICAL ENGINEERING

B.Tech. I Year

S.No.	Course code	Subject	Th	Tu/Drg/Lab.	Credits
1.	13A52101	Communicative English	2	- - -	3
2.	13A56101	Engineering Physics	2	- - -	3
3.	13A51101	Engineering Chemistry	2	- - -	3
4.	13A54101	Mathematics - I	3	1 - -	5
5.	13A12101	Programming in C & Data Structures	3	1 - -	5
6.	13A01101	Engineering Mechanics	3	1 - -	5
7.	13A03101	Engineering Drawing *	1	- 5 -	5
8.	13A12102	Programming in C & Data Structures Lab	-	- - 3	4
9.	13A99102	Engineering Physics & Engineering Chemistry Lab **	-	- - 3	4
10.	13A99103	Engineering & IT Workshop #	-	- - 3	4
11.	13A52102	English Language Comm. Skills Lab	-	- - 3	4
Total Credits					45

Th = Theory; Tu = Tutorial, Drg= Drawing & Lab = Laboratory:

* Engineering Drawing will have University External Exam.

** The students shall attend the Physics lab and Chemistry lab in alternate weeks. The end exam shall be conducted separately and average of the two exams shall be recorded by the University exam section.

The **s**tudents shall attend Engineering workshop and IT work shop as a single lab every week and the end exam is conducted as a single lab. Sharing the Maximum marks and time for one task each from Engineering workshop and IT workshop. The sum of the marks awarded shall be recorded

B.Tech. II - I Semester

S.No	Course code	Subject	Theory	Tu/Drg/Lab	Credits
1.	13A54301	Mathematics – II	3	1 - -	3
2.	13A01308	Mechanics of Solids	3	1 - -	3
3.	13A99302	Electrical & Electronics Engineering	3	1 - -	3
4.	13A03301	Material Science and Engineering	3	1 - -	3
5.	13A03302	Thermodynamics	3	1 - -	3
6.	13A03303	Machine Drawing		6	3
7.	13A99303	Material Science Lab & Mechanics of Solids Lab		- - 3	2
8.	13A99304	Electrical & Electronics Engineering Lab	-	- - 3	2
9.	13A52301	Human Values and Professional Ethics(Audit Course)	2	- - -	-
Total Credits					22

B.Tech. II - II Semester

S.No	Course code	Subject	Theory	Tu / Lab	Credits
1.	13A01403	Environmental Science	3	1 -	3
2.	13A54303	Probability and Statistics	3	1 -	3
3.	13A03401	Kinematics of Machinery	3	1 -	3
4.	13A03402	Thermal Engineering – I	3	1 -	3
5.	13A01408	Mechanics of Fluids	3	1 -	3
6.	13A03403	Manufacturing Technology	3	1 -	3
7.	13A03404	Thermal Engineering Lab	-	- 3	2
8.	13A03405	Manufacturing Technology Lab	-	- 3	2
Total Credits					22

NOTE: For Machine Drawing:

- *The End exam will be for 4 hrs in the following format*
- *All answers should be on the drawing sheet only. Answers on the drawing sheet only will be valued.*
- *First Angle Projections*
  - *Q1 Questions set on section I of the syllabus 2 out of 3 or 2 out of 4 to be answered with a weightage of 4 marks each-08 marks.*
  - *Q2 Questions set on section II of the syllabus 2 out of 3 to be answered with a weightage of 10 marks each-20 mrks.*
  - *Q3 Drawing of assembled views of section III items of syllabus with a weightage of 42 marks*

B.Tech. III - I Semester

S.No	Course code	Subject	Theory	Tu / Lab	Credits
1.	13A03501	Hydraulic Machinery	3	1 -	3
2.	13A03502	Thermal Engineering - II	3	1 -	3
3.	13A03503	Dynamics of Machinery	3	1 -	3
4.	13A03504	Metal Forming Processes	3	1 -	3
5.	13A03505	Design of Machine Members - I	3	1 -	3
6.	13A03506	Heat Transfer	3	1 -	3
7.	13A03507	Heat Transfer Lab	-	- 3	2
8.	13A01509	Fluid Mechanics & Hydraulic Machinery Lab	-	- 3	2
Total Credits					22

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Revised Course Structure for B.Tech.- R13 Regulations

MECHANICAL ENGINEERING

III - II Semester

S.No	Course code	Subject	Theory	Tu / Lab	Credits
1.	13A52501	Managerial Economics & Financial Analysis.	3	1 -	3
2.	13A03601	CAD/CAM.	3	1 -	3
3.	13A03602	Machine Tools.	3	1 -	3
4.	13A03603	Refrigeration & Air Conditioning.	3	1 -	3
5.	13A03604	Design of Machine Members – II.	3	1 -	3
6.	13A03605 13A03606 13A03607	**Choice Based Credit Courses** a. Non Conventional Source of Energy. b. Total Quality Management. c. Mechatronics.	3	1 -	3
7.	13A03608	CAD Lab.	-	- 4	2
8.	13A03609	Machine Tools Lab.	-	- 4	2
9.	13A52502	Advanced English Language Communication Skills Lab (Audit Course)		3	
10	13A03610	Comprehensive Online Examination – II	-	- -	1
			18	6 11	23

DIRECTOR
Academic & Planning
JNT University Anantapur,
Ananthapuramu-515 002.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Course Structure for Mechanical Engineering
B. Tech Course
(2013-14)

IV B. Tech – I Sem

S.No.	Course Code	Subject	Theory	Tu	Lab	Credits
1	13A03701	Operations Research	3	1	-	3
2	13A03702	Automation and Robotics	3	1	-	3
3	13A03703	Finite Element Methods	3	1	-	3
4	13A03704	Metrology and Measurements	3	1	-	3
5	13A03705 13A03706 13A03707	CBCC II a. Automobile Engineering. b. Tool Design c. Tribology	3	1	-	3
6	13A03708 13A03709 13A03710	CBCC III a. Computational Fluid Dynamics b. Concurrent Engineering c. Production & Operations Management	3	1	-	3
7	13A03711	Metrology and Measurements Laboratory	-	-	4	2
8	13A03712	Computer Aided Engineering Laboratory	-	-	4	2
		Total	**18**	**06**	**08**	**22**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Course Structure for Mechanical Engineering
B. Tech Course
(2013-14)

IV B. Tech – II Sem

S. No.	Course Code	Subject	Theory	Tu	Lab	Credits
1	13A03801 13A03802 13A03803	MOOCS I a. Industrial Engineering b. Entrepreneurship c. Composite Materials	3	1	-	3
2	13A03804 13A03805 13A03806	MOOCS II a. Power Plant Engineering b. Gas Turbines and Jet Propulsion c. Energy Management	3	1	-	3
3	13A03807 13A03808 13A03809	MOOCS III a. Modern Manufacturing Methods b. Rapid Proto Typing c. Product Design	3	1	-	3
4	13A03810	Technical Seminar	-	-	4	2
5	13A03811	Project work	-	-	24	12
		Total	**09**	**03**	**28**	**23**

3 Theory + 1 Technical Seminar + 1 Project work

***Either by MOOCS manner or Self study or Conventional manner**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. I Year	**Th**	**Tu**	**C**
	2	**0**	**3**

Common to All Branches

(13A52101) COMMUNICATIVE ENGLISH

Preamble:

English is an international language as well as a living and vibrant one. People have found that knowledge of English is a passport for better career and for communication with the entire world. As it is a language of opportunities in this global age, English is bound to expand its domain of use everywhere. The syllabus has been designed to enhance communication skills of the students of Engineering and Technology. The prescribed books serve the purpose of preparing them for everyday communication and to face global competitions in future.

The first text prescribed for detailed study focuses on LSRW skills and vocabulary development. The teachers should encourage the students to use the target language. The classes should be interactive and student-centered. They should be encouraged to participate in the classroom activities keenly.

The text for non-detailed study is meant for extensive reading/reading for pleasure by the students. They may be encouraged to read some selected topics on their own, which could lead into a classroom discussion. In addition to the exercises from the texts done in the class, the teacher can bring variety by using authentic materials such as newspaper articles, advertisements, promotional material etc.

Course Objective:

- *To enable the students to communicate in English for academic and social purpose.*
- *To enable the students to acquire structure and written expressions required for their profession.*
- *To develop the listening skills of the students.*
- *To inculcate the habit of reading for pleasure.*
- *To enhance the study skills of the students with emphasis on LSRW skills.*

Learning Outcome:

- *The students will get the required training in LSRW skills through the prescribed texts and develop communicative competence.*

UNIT I

Chapter entitled 'Humour' from "Using English"

Chapter entitled 'Biography - (Homi Jehangir Bhabha)' from "New Horizons"

Listening - Techniques - Importance of phonetics

L- Meet & Greet and Leave taking, Introducing Oneself and Others (Formal and Informal situations)

R- Reading Strategies -Skimming and Scanning

W- Writing strategies- sentence structures

G-Parts of Speech –Noun-number, pronoun-personal pronoun, verb- analysis

V-Affixes-prefix and suffix, root words, derivatives

UNIT II

Chapter entitled 'Inspiration' from "Using English"

Chapter entitled 'Biography - (Jagadish Chandra Bose)' from "New Horizons"

L- Listening to details

S- Apologizing, Interrupting, Requesting and Making polite conversations

R- Note making strategies

W- Paragraph-types- topic sentences, unity, coherence, length , linking devices

G-Auxiliary verbs and question tags

V- synonyms-antonyms, homonyms, homophones, homographs, words often confused

UNIT III

Chapter entitled 'Sustainable Development' from "Using English"

Chapter entitled 'Short Story - (The Happy Prince)' from "New Horizons"

L- Listening to themes and note taking

S- Giving instructions and Directions, making suggestions, Accepting ideas, fixing a time and Advising

R- Reading for details -1

W- Resume and cover letter

G- Tenses – Present tense, Past tense and Future tense

V-Word formation and One-Word Substitutes

UNIT IV

Chapter entitled 'Relationships' from "Using English"

Chapter entitled 'Poem - (IF by Rudyard Kipling)' from "New Horizons"

L- Listening to news

S- Narrating stories, Expressing ideas and opinions and telephone skills

R- Reading for specific details and Information

W- Technical Report writing-strategies, formats-types-technical report writing

G- Voice and Subject–Verb Agreement

V- Idioms and prepositional Phrases

UNIT V

Chapter entitled 'Science and Humanism' from "Using English"

Chapter entitled 'Autobiography - (My Struggle for an Education by Booker T.Washington)' from "New Horizons"

L- Listening to speeches

S- Making Presentations and Group Discussions

R- Reading for Information

W- E-mail drafting

G- Conditional clauses and conjunctions

V- Collocations and Technical Vocabulary and using words appropriately

Text Books:

1. ***Using English*** *published by Orient Black Swan.*
2. ***New Horizons*** *published by Pearson.*

Reference Books:

1. ***Raymond Murphy's English Grammar with CD,*** *Murphy, Cambridge University Press, 2012.*
2. ***English Conversation Practice*** *–Grant Taylor, Tata McGraw Hill, 2009.*
3. ***Communication Skills,*** *Sanjay Kumar & Pushpalatha Oxford University Press, 2012.*
4. ***A Course in Communication Skills****- Kiranmai Dutt & co. Foundation Books, 2012.*
5. ***Living English Structures****- William Standard Allen-Pearson, 2011.*
6. ***Current English Grammar and Usage,*** *S M Guptha, PHI, 2013.*
7. ***Modern English Grammar****-Krishna SWAMI,.McMillan, 2009.*
8. ***Powerful Vocabulary Builder****- Anjana Agarwal, New Age International Publishers, 2011.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. I Year	**Th**	**Tu**	**C**
	2	**0**	**3**

Common to All Branches

(13A56101) ENGINEERING PHYSICS

Preamble:

There has been an exponential growth of knowledge in the recent past opening up new areas and challenges in the understanding of basic laws of nature. This helped to the discovery of new phenomena in macro, micro and nano scale device technologies. The laws of physics play a key role in the development of science, engineering and technology. Sound knowledge of physical principles is of paramount importance in understanding new discoveries, recent trends and latest developments in the field of engineering.

To keep in pace with the recent scientific advancements in the areas of emerging technologies, the syllabi of engineering physics has been thoroughly revised keeping in view of the basic needs of all engineering branches by including the topics like optics, crystallography, ultrasonics, quantum mechanics, free electron theory. Also new phenomenon, properties and device applications of semiconducting, magnetic, superconducting and nano materials along with their modern device applications have been introduced.

Course Objective:

- *To evoke interest on applications of superposition effects like interference and diffraction, the mechanisms of emission of light, achieving amplification of electromagnetic radiation through stimulated emission, study of propagation of light through transparent dielectric waveguides along with engineering applications.*
- *To enlighten the periodic arrangement of atoms in crystals, direction of Bragg planes, crystal structure determination by X-rays and also to understand different types of defects in crystals adnoun-destructive evaluation using ultrasonic techniques.*
- *To get an insight into the microscopic meaning of conductivity , classical and quantum free electron model, the effect of periodic potential on electron motion, evolution of band theory to distinguish materials and to understand electron transport mechanism in solids.*
- *To open new avenues of knowledge and understanding on semiconductor based electronic devices, basic concepts and applications of semiconductor and magnetic materials have been introduced which find potential in the emerging micro device applications.*
- *To give an impetus on the subtle mechanism of superconductors in terms of conduction of electron pairs using BCS theory, different properties exhibited by them and their fascinating applications. Considering the significance of microminiaturization of electronic devices and significance of low dimensional materials, the basic concepts of nanomaterials, their synthesis, properties and applications in modern emerging technologies are elicited.*

Learning Outcome:

- *The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics, lasers and fibre optics.*
- *The important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction are focused along with defects in crystals and ultrasonic non-destructive techniques.*
- *The discrepancies between the classical estimates and laboratory observations of physical properties exhibited by materials would be lifted through the understanding of quantum picture of subatomic world.*
- *The electronic and magnetic properties of materials were successfully explained by free electron theory and focused on the basis for the band theory.*
- *The properties and device applications of semiconducting and magnetic materials are illustrated.*

- *The importance of superconducting materials and nanomaterials along with their engineering applications are well elucidated.*

UNIT 1

PHYSICAL OPTICS, LASERS AND FIBRE OPTICS:

Physical Optics: Introduction - Interference in thin films by reflection – Newton's Rings – Fraunhofer diffraction due to single slit, double slit and diffraction grating.

Lasers: Introduction - Characteristics of laser – Spontaneous and stimulated emission of radiation – Einstein's coefficients - Population inversion – Excitation mechanisms and optical resonator - Ruby laser - He-Ne laser – Applications of lasers.

Fibre optics: Introduction– Construction and working principle of optical fiber –Numerical aperture and acceptance angle – Types of optical fibers – Attenuation and losses in fibers - Optical fiber communication system – Applications of optical fibers in communications, sensors and medicine.

UNIT II

CRYSTALLOGRAPHY AND ULTRASONICS:

Crystallography: Introduction – Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Structures of NaCl and Diamond –Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg's law –Laue and Powder methods – Defects in solids: point defects, line defects (qualitative) - screw and edge dislocation, burgers vector.

Ultrasonics: Introduction – Production of ultrasonics by piezoelectric method – Properties and detection – Applications in non-destructive testing.

UNIT III

QUANTUM MECHANICS AND FREE ELECTRON THEORY:

Quantum Mechanics: Introduction to matter waves – de'Broglie hypothesis - Heisenberg's uncertainty principle and its applications - Schrodinger's time independent and time dependent wave equation – Significance of wave function - Particle in a one dimensional infinite potential well - Eigen values and Eigen functions.

Free electron theory: Classical free electron theory –- Sources of electrical resistance - Equation for electrical conductivity - Quantum free electron theory – Fermi-Dirac distribution –Kronig-Penny model(qualitative) – Origin of bands in solids – Classification of solids into conductors, semiconductors and insulators.

UNIT IV

SEMICONDUCTORS AND MAGNETIC MATERIALS:

Semiconductor Physics: Introduction – Intrinsic and extrinsic semiconductors – Drift & diffusion currents and Einstein's equation – Hall effect - Direct and indirect band gap semiconductors – Working principle of p-n junction diode, LED, laser diode and photodiode.

Magnetic materials: Introduction and basic definitions – Origin of magnetic moments – Bohr magneton – Classification of magnetic materials into dia, para, ferro, antiferro and ferri magnetic materials – Hysteresis - Soft and hard magnetic materials and applications.

UNIT V

SUPERCONDUCTIVITY AND PHYSICS OF NANOMATERIALS:

Superconductivity: Introduction – Meissner effect - Properties of superconductors – Type I and type II superconductors – Flux quantization – London penetration depth – ac and dc Josephson effects – BCS theory(qualitative) – High T_c superconductors - Applications of superconductors.

***Physics of Nanomaterials*:** Introduction - Significance of nanoscale - Surface area and quantum confinement – Physical properties: optical, thermal, mechanical and magnetic properties – Synthesis of nanomaterials: ball mill, chemical vapour deposition, sol-gel, plasma arcing and thermal evaporation – Properties of Carbon nanotubes – High strength applications – Properties of graphene – Graphene based Field Effect Transistor - Applications of nanomaterials.

Text Books:

1. Engineering physics – S. ManiNaidu, Pearson Education, I Edition, 2012.
2. Engineering Physics – V. Rajendran, MacGraw Hill Publishers, I Edition,2008.

Reference Books:

1. Engineering Physics – V. Rajendran, K.Thyagarajan Tata MacGraw Hill Publishers, III Edition, 2012.
2. Engineering Physics – RV.S.S.N. Ravi Kumar and N.V. Siva Krishna, Maruthi Publications , 2013
3. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish University Press, I Edition, 2009.
4. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning, I Edition, 2012
5. Engineering Physics – Hitendra K Mallik and AK Singh, McGraw Hill Education Pvt. Ltd, New Delhi , I Edition, 2010
6. Engineering Physics – M. Arumugam, Anuradha Publications II Edition, 1997.
7. Engineering physics – M.N. Avadhanulu and P.G. KshirSagar, Chand and Co, Revised Edition, 2013.
8. Solid State Physics – A.J. Dekkar, McMillan Publishers, Latest edition, 2012.
9. Engineering Physics – Gaur and Gupta Dhanapati, Rai Publishers , 7th Edition, 1992.
9. Text book of Nanoscience and Nanotechnology: B S Murthy, P.Shankar, Baldev Raj B B Rath, James Murday, University Press, I Edition, 2012.
10. Carbon Nanotubes and Graphene Device Physics – H.S. Philip Wong, Deji Akinwande, Cambridge University Press, 2011.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. I Year	**Th**	**Tu**	**C**
	2	**0**	**3**

Common to All Branches

(13A51101) ENGINEERING CHEMISTRY

Preamble:

Knowledge in chemistry serves as basic nutrient for the understanding and thereby design of materials of importance in life. Thus the advancement in Engineering is depend on the outcome of basic sciences. Many advances in engineering either produce a new chemical demand as in the case of polymers or wait upon chemical developments for their applications as in the case of implants and alloys. Currently the electronics and computer engineers are looking forward for suitable biopolymers and nano materials for use in miniature super computers, the electrical materials engineers are in search of proper conducting polymers, the mechanical engineers are on lookout for micro fluids and the civil engineers are looking for materials that are environmental friendly, economical but long lasting.

Course Objective:

- *The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial/engineering applications.*
- *The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering.*
- *The lucid explanation of the topics will help students understand the fundamental concepts and apply them to design engineering materials and solve problems related to them. An attempt has been made to logically correlate the topic with its application.*
- *The extension of fundamentals of electrochemistry to energy storage devices such as commercial batteries and fuel cells is one such example.*
- *After the completion of the course, the student would understand about the concepts of chemistry in respect of Electrochemical cells, fuel cells, mechanism of corrosion and factors to influence, polymers with their applications, analytical methods, engineering materials and water chemistry.*

Learning Outcome:

The student is expected to:

- *Understand the electrochemical sources of energy*
- *Understand industrially based polymers, various engineering materials.*
- *Differentiate between hard and soft water. Understand the disadvantages of using hard water domestically and industrially. Select and apply suitable treatments domestically and industrially.*

UNIT 1

ELECTROCHEMISTRY:

Review of electrochemical cells, Numerical calculations, Batteries: Rechargeable batteries (Lead acid, Ni-Cd, Lithium Ion Batteries). Fuels cells: (Hydrogen-Oxygen and Methanol-Oxygen).

Electrochemical sensors: Potentiometric Sensors and voltammetric sensors. Examples: analysis of Glucose and urea.

Corrosion: Electrochemical Theory of corrosion, Factors affecting the corrosion. Prevention: Anodic and cathodic protection and electro and electroless plating.

UNIT II

POLYMERS:

Introduction to polymers, Polymerisation process, mechanism: cationic, anionic, free radical and coordination covalent, Elastomers (rubbers), Natural Rubber, Compounding of Rubber,

Synthetic Rubber: Preparation, properties and engineering applications of Buna-S, buna-N, Polyurethene, Polysulfide (Thiokol) rubbers. Plastomers: Thermosetting and Thermoplatics, Preparation, properties and Engineering applications , PVC, Bakelite, nylons.
Conducting polymers: Mechanism, synthesis and applications of polyacetyline, polyaniline. Liquid Crystals: Introduction, classification and applications.
Inorganic Polymers: Basic Introduction, Silicones, Polyphospazins (-(R)2-P=N-) applications.

UNIT III
FUEL TECHNOLOGY:
Classifications of Fuels – Characteristics of Fuels- Calorific Value – Units, Numerical Problems, Solid Fuels–Coal, Coke : Manufacture of Metallurgical Coke by Otto Hoffmann's by product oven processes.
Liquid Fuels: Petroleum: Refining of Petroleum, Gasoline: Octane Number, Synthetic Petrol: Bergius Processes, Fischer Troph's synthesis.
Power Alcohol: Manufacture, Advantages and Disadvantages of Power Alcohol
Gaseous Fuels: Origin, Production and uses of Natural gas, Producer gas, Water gas, Coal gas and Biogas. Flue Gas analysis by Orsat's apparatus, Solving of problems on Combustion.

UNIT IV
CHEMISTRY OF ENGINEERING MATERIALS:
Semiconducting and Super Conducting materials-Principles and some examples, Magnetic materials – Principles and some examples, Cement: Composition, Setting and Hardening (Hydration and Hydrolysis), Refractories: Classification, properties and applications, Lubricants: Theory of lubrication , properties of lubricants and applications, Rocket Propellants: Classification, Characteristics of good propellant

UNIT V
WATER TREATMENT:
Impurities in water, Hardness of water and its Units, Disadvantages of hard water, Estimation of hardness by EDTA method, Numerical problems on hardness, Estimation of dissolved oxygen, Alkalinity, acidity and chlorides in water, Water treatment for domestic purpose (Chlorination, Bleaching powder, ozonisation)
Industrial Use of water: For steam generation, troubles of Boilers: Scale & Sludge, Priming and Foaming, Caustic Embrittlement and Boiler Corrosion.
Treatment of Boiler Feed water: Internal Treatment: Colloidal, Phosphate, Carbonate, Calgon and sodium aluminate treatment.External Treatment: Ion-Exchange and Permutit processes.
Demineralisation of brackish water: Reverse Osmosis and Electrodialysis

Text Books:

1. *Engineering Chemistry by KNJayaveera, GVSubba Reddy and C. Ramachandraiah, McGraw Hill Higher Education, New Delhi, Fourth Edition, 2012.*
2. *A Text book of Engineering Chemistry by S.S Dhara, S.S.Umare, S. Chand Publications, New Delhi, 12th Edition, 2010.*

Reference Books:

1. *A Text Book of Enigneering Chemistry, Jain and Jain, Dhanapath Rai Publishing Company, New Delhi, 15th Edition, 2010.*
2. *Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH, Publications India Pvt Limited, Chennai, 2nd Edition, 2012.*
3. *Concepts of Engineering Chemistry- Ashima Srivastava and N.N. Janhavi, Acme Learning Pvt Ltd, First Edition, 2013.*
4. *Text Book of Engineering Chemistry – C. Parameswara Murthy, C.V.Agarwal and Andra Naidu, BS Publications, Hyderabad, 3rd Edition, 2008.*
5. *Text Book of Engineering Chemistry, Shashichawla, Dhanapath Rai Publications, New Delhi, 4th Edition, 2011.*
6. *Engineering Chemistry, K. Sesha Maheswaramma and Mrudula Chugh, Pearson Education, First Edition, 2013.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. I Year	**Th**	**Tu**	**C**
	3	**1**	**5**

Common to All Branches

(13A54101) MATHEMATICS – I

Course Objective:

- *To train the students thoroughly in Mathematical concepts of ordinary differential equations and their applications in electrical circuits, deflection of beams, whirling of shafts.*
- *To prepare students for lifelong learning and successful careers using mathematical concepts of differential, Integral and vector calculus, ordinary differential equations and Laplace transforms.*
- *To develop the skill pertinent to the practice of the mathematical concepts including the student abilities to formulate the problems, to think creatively and to synthesize information.*

Learning Outcome:

- *The students become familiar with the application of differential, integral and vector calculus, ordinary differential equations and Laplace transforms to engineering problems.*
- *The students attain the abilities to use mathematical knowledge to analyze and solve problems in engineering applications.*

UNIT I

Exact, linear and Bernoulli equations, Applications to Newton's law of cooling, law of natural growth and decay, orthogonal trajectories.

Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type e^{ax}, Sin ax, cos ax, polynomials in x, e^{ax} V(x), xV(x), method of variation of parameters. Applications to oscillatory electrical circuits, Deflection of Beams, whirling of shafts.

UNIT II

Taylor's and Maclaurin's Series - Functions of several variables – Jacobian – Maxima and Minima of functions of two variables, Lagrange's method of undetermined Multipliers with three variables only. Radius of curvature, center of curvature, Involutes evolutes, envelopes.

UNIT III

Curve tracing – Cartesian, polar and parametric curves. Length of curves.

Multiple integral – Double and triple integrals – Change of Variables – Change of order of integration. Applications to areas and volumes, surface area of solid of revolution in Cartesian and polar coordinates using double integral.

UNIT IV

Laplace transform of standard functions – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function.

Differentiation and integration of transform – Application of Laplace transforms to ordinary differential equations of first and second order.

UNIT V

Vector Calculus: Gradient – Divergence – Curl and their properties; Vector integration – Line integral - Potential function – Area – Surface and volume integrals. Vector integral theorems: Green's theorem – Stoke's and Gauss's Divergence Theorem (Without proof). Application of Green's – Stoke's and Gauss's Theorems.

Text Books:

1. *Higher Engineering Mathematics, B.S.Grewal, Khanna publishers-42 Edition(2012)*
2. *Engineering Mathematics, Volume - I, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher 1st Edition (2010)*

Reference Books:

1. *Engineering Mathematics Volume-I, by T.K.V. Iyengar, S.Chand publication-12th Edition(2013)*
2. *Engineering Mathematics, Volume - I, by G.S.S.Raju, CENGAGE publisher.(2013)*
3. *Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India-10thEdition(2012)*
4. *Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers(2008)*
5. *Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier-1st Edition(2001)*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. I Year	**Th**	**Tu**	**C**
	3	**1**	**5**

(13A12101) PROGRAMMING IN C & DATA STRUCTURES

Course Objective:

- *To make the student understand problem solving techniques*
- *Students will be able to understand the syntax and semantics of C programming language and other features of the language*
- *Get acquaintance with data structures, searching and sorting techniques*

Learning Outcome:

- *Student can effectively apply problem solving techniques in designing the solutions for a wide-range of problems*
- *Student can choose appropriate data structure and control structure depending on the problem to be solved*
- *Student can effectively use existing data structures and design new data structures appropriate to the problem to be solved*
- *Student can modularize the problem and also solution*
- *Student can use appropriate searching and sorting technique to suit the application.*

UNIT I

Introductory Concepts: Introduction to computers, What is a Computer, Block diagram of Computer, Computer Characteristics, Hardware Vs Software, How to develop a program, Software development life cycle, Structured programming, Modes of operation, Types of programming languages, Introduction to C, Desirable program characteristics.

Introduction to Computer problem solving: Introduction, The problem solving aspect, Top down design, Implementation of algorithms.

Introduction to C programming: The C character set, Writing first program of C, Identifiers and key words, A more useful C program, Entering the program into the computer, Compiling and executing the program, Data types, Constants, Variables and arrays, Declarations, Expressions, Statements, Symbolic Constants.

Operators and Expressions: Arithmetic operators, Unary operators, Relational and Logical operators, Assignment operators, Conditional operator, Library functions.

Fundamental algorithms: Exchanging the values of two variables, Factorial computation, Sine function computation, Reversing the digits of an integer, Generating prime numbers.

UNIT II

Data Input and Output: Preliminaries, Single character input-getchar function, Single character output-putchar function, Entering input data-the scanf function, More about the scanf function, Writing output data-The printf function, More about the printf function, The gets and puts functions, Interactive(conversational) programming.

Preparing and running a complete C program: Planning a C program, Writing a C program, Error diagnostics, Debugging techniques.

Control statements: Preliminaries, Branching: if-else statement, Looping: The while statement, More looping: The do-while statement, Still more looping: The for statement, Nested control structures, The switch statement, Break statement, Continue statement, The comma operator, The goto statement.

Functions: A brief overview, Defining a function, Accessing a function, Function prototypes, Passing arguments to a function, Recursion

UNIT III

Program Structure: Storage classes, Automatic variables, External (global) variables, Static variables, Multi file programs, More about library functions.

Arrays: Defining an array, Processing an array, Passing arrays to functions, Multi dimensional arrays.

Array Techniques: Array order reversal, Removal of duplicates from an ordered array, Finding the K^{th} smallest element.

Merging, Sorting and Searching: The two way merge, Sorting by selection, Sorting by exchange, Sorting by insertion, Sorting by partitioning, Recursive Quick sort, Binary Search.

Strings: Defining a string, NULL character, Initialization of strings, Reading and Writing a string, Processing the strings, Character arithmetic, Searching and Sorting of strings, Some more Library functions for strings

UNIT IV

Pointers: Fundamentals, Pointer Declarations, Passing pointer to a function, Pointers and one dimensional array, Dynamic memory allocation, Operations on pointers, Pointers and multi dimensional arrays, Arrays of pointers, Passing functions to other functions, More about pointer declarations.

Structures and Unions: Defining a structure, Processing a structure, User defined data type (typedef), Structures and Pointers, Passing structures to functions, Unions.

File Handling: Why files, Opening and closing a data file, Reading and Writing a data file, Processing a data file, Unformatted data files, Concept of binary files, Accessing the file randomly (using fseek).

Additional Features: Register variables, Bitwise operations, Bit Fields, Enumerations, Command line parameters, More about Library functions, Macros, The C Preprocessor

UNIT V

Introduction to Data Structures: Data abstraction

Stacks and Queues: Stacks, Stacks using dynamic arrays, Queues, Circular Queues using dynamic arrays

Evaluations of expressions: Expressions, Evaluating postfix expressions, Infix to Postfix, Multiple Stacks and Queues.

Linked Lists: Singly Linked lists and chains, Representing chains in C, Linked Stacks and Queues.

Text Books:

1. *"Programming with C", Byron Gottfried, Third Edition, Schaum's Outlines, Mc Graw Hill.*
2. *"Fundamentals of Data Structures in C", Horowitz, Sahni, Anderson-freed, Second Edition, Universities Press.*
3. *"How to Solve it by Computer", R.G. Dromey, Pearson. (Pascal implementations may be considered without loss of generality or Instructors may replace them with C language programs)*

Reference Books:

1. *"Programming in C", Pradip Dey, Manas Ghosh, Oxford Higher Education*
2. *"Programming in C and Data Structures", Hanly, Koffman, Kamthane, Ananda Rao, Pearson.*
3. *"Programming in C", Reema Thareja, Oxford Higher Education.*
4. *"Computer Fundamentals and C Programming", First Edition, Dr.P.Chenna Reddy, Available at: www.pothi.com.*
5. *"Data Structure and Program Design in C", Second Edition, Kruse, Tondo, Leung, Mogalla, Pearson.*
6. *"Programming with C", R.S. Bichkar, University Press.*
7. *"Computer Science A Structured Programming Approach Using C", Third Edition, Fourouzan & Gilberg, Cengage Learning.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. I Year	**Th**	**Tu**	**C**
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(13A01101) ENGINEERING MECHANICS

Course Objective:

This course will serve as a basic course by introducing the concepts of basic mechanics which will help as a foundation to various courses.

UNIT I

Introduction of Engineering Mechanics – Basic concepts - System of Forces – Moment of Forces and its Application – Couples and Resultant of Force System – Equilibrium of System of Forces - Degrees of Freedom – Free body diagrams –Types of Supports – Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT II

Friction: Types of friction– laws of Friction – Limiting friction- Cone of limiting friction– static and Dynamic Frictions – Motion of bodies – Wedge, Screw jack and differential Screw jack.

UNIT III

Centroid and Center of Gravity: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies – Area moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures.

Mass Moment of Inertia: Moment of Inertia of Simple solids – Moment of Inertia of composite masses.(Simple problems only)

UNIT IV

Kinematics: Rectilinear and Curvilinear motion – Velocity and Acceleration – Motion of A Rigid Body – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a particle and Analysis as a Rigid Body in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies – Work Energy Method – Equation for Translation – Work Energy application to Particle Motion, Connection System – Fixed axis Rotation and Plane Motion.

UNIT V

Analysis of Perfect Frames: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints, method of sections and tension coefficient method for vertical loads, horizontal loads and inclined loads.

Mechanical Vibrations: Definitions, Concepts-Simple Harmonic motion-Free vibrations-Simple Compound and Torsional pendulum- Numerical problems

Text Books*:*

1. *Engineering Mechanics by Shames & Rao – Pearson Education.*
2. *Engineering Mechanics by Dr.R.k.Bansal, Lakshmi Publications.*
3. *Engineering Mechanics – B. Bhattacharyya, Oxford University Publications.*

Reference Books:

1. *Engineering Mechanics by Fedrinand L.Singer – Harper Collings Publishers.*
2. *Engineering Mechanics by Seshigiri Rao, Universities Press, Hyderabad.*
3. *Engineering Mechanics by Rajsekharan, Vikas Publications.*
4. *Engineering Mechanics (Statics and Dynamics) by Hibller and Gupta; Pearson Education.*
5. *Engineering Mechanics by S.Timoshenko, D.H.Young and J.V.Rao, Tata McGraw-Hill Company.*
6. *Engineering Mechanics by Chandramouli, PHI publications.*
7. *Engineering Mechanics –Arthur P. Boresi and Richard J. Schmidt. – Brooks/Cole – Cengage Learning.*

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B.Tech. I Year	**Th**	**Drg**	**C**
	1	**5**	**5**

(13A03101) ENGINEERING DRAWING

Course Objective:

- *By studying the engineering drawing, a student becomes aware of how industry communicates technical information. Engineering drawing teaches the principles of accuracy and clarity in presenting the information necessary about objects.*
- *This course develops the engineering imagination i.e., so essential to a successful design, By learning techniques of engineering drawing changes the way one things about technical images.*
- *It is ideal to master the fundamentals of engineering drawing first and to later use these fundamentals for a particular application, such as computer aided drafting. Engineering Drawing is the language of engineers, by studying this course engineering and technology students will eventually be able to prepare drawings of various objects being used in technology.*

UNIT I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance-Conventions in Drawing-Lettering – BIS Conventions. Curves used in Engineering Practice.

a) Conic Sections including the Rectangular Hyperbola- General method only,
b) Cycloid, Epicycloids and Hypocycloid
c) Involutes
d) Helices

UNIT II

Projection of Lines: Inclined to one or both planes, Problems on projections, Finding True lengths & traces only.

Projections of Planes: Projections of regular plane surfaces/figures, Projection of lines and planes using auxiliary planes.

UNIT III

Projections of Solids: Projections of Regular Solids inclined to one or both planes-Auxiliary Views.

Sections and Developments of Solids: Section Planes and Sectional View of Right Regular Solids-Prism, cylinder, Pyramid and Cone. True shapes of the sections.Development of Surfaces of Right Regular Solids-Prism, Cylinder, Pyramid, Cone and their Sectional Parts.

UNIT IV

Isometric and Orthographic Projections: Principles of isometric projection- Isometric Scale-Isometric Views- Conventions- Isometric Views of lines, Planes Figures, Simple and Compound Solids-Isometric Projection of objects having non-isometric lines. Isometric projections of spherical parts. Conversion of isometric Projections/Views of Orthographic Views-Conventions.

UNIT V

Interpenetration of Right Regular Solids: Projections of Curves of intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Square Prism Vs Square Prism.

Perspective Projections: Perspective Vice of Plane Figures and simple Solids, Vanishing point method (General Methods only).

Text Books*:*

1. *Engineering Drawing, N.D. Bhat, Charotar Publishers*
2. *Engineering Drawing, K.L. Narayana& P. Kannaih, Scitech Publishers, Chennai*

Reference Books*:*

1. *Engineering Drawing, Johle, Tata McGraw-Hill Publishers*
2. *Engineering Drawing, Shah and Rana,2/e, Pearson Education*

3. *Engineering Drawing and Graphics, Venugopal/New age Publishers*
4. *Engineering Graphics, K.C. John, PHI,2013*
5. *Engineering Drawing and Graphics, Venugopal / New age Publishers*
6. *Engineering Drawing, B.V.R. Guptha, J.K. Publishers*

Suggestions:

1. *Student is expected to buy a book mentioned under 'Text books' for better understanding.*
2. *Students can find the applications of various conics in engineering and application of involute on gear teeth. The introduction for drawing can be had on line from:*
   - *Introduction to engineering drawing with tools – youtube*
   - *Http-sewor. Carleton.ca /- g kardos/88403/drawing/drawings.html*
   - *Conic sections-online. red woods.edu*
3. *This subject also paves the way for learing Auto Cad, CAD / CAM, CATIA and Pro E which are advanced software packages needed for every mechanical engineer (To be taught & examined in First angle projection). The skill acquired by the student in this subject is very useful in conveying his ideas to the layman easily.*

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B.Tech. I Year	**L**	**C**
	3	**4**

(13A12102) PROGRAMMING IN C & DATA STRUCTURES LAB

Course Objective:

- *To make the student learn C Programming language.*
- *To make the student solve problems, implement them using C language.*
- *To strengthen the ability to identify and apply the suitable data structure for the given real world problem.*

Learning Outcome:

- *Apply problem solving techniques to find solutions to problems.*
- *Able to use C language features effectively and implement solutions using C language.*
- *Be capable to identity the appropriate data structure for a given problem or application.*
- *Improve logical skills.*

LIST OF EXPERIMENTS/TASKS

1. Practice DOS and LINUX Commands necessary for design of C Programs.
2. Study of the Editors, Integrated development environments, and Compilers in chosen platform.
3. Write, Edit, Debug, Compile and Execute Sample C programs to understand the programming environment.
4. Practice programs: Finding the sum of three numbers, exchange of two numbers, maximum of two numbers, to read and print variable values of all data types of C language, to find the size of all data types, to understand the priority and associativity of operators using expressions, to use different library functions of C language.
5. Write a program to find the roots of a quadratic equation.
6. Write a program to compute the factorial of a given number.
7. Write a program to check whether the number is prime or not.
8. Write a program to find the series of prime numbers in the given range.
9. Write a program to generate Fibonacci numbers in the given range.
10. Write a program to find the maximum of a set of numbers.
11. Write a program to reverse the digits of a number.
12. Write a program to find the sum of the digits of a number.
13. Write a program to find the sum of positive and negative numbers in a given set of numbers.
14. Write a program to check for number palindrome.
15. Write a program to evaluate the sum of the following series up to 'n' terms e $^{x}=1+x+x^2/2!+x^3/3!+x^4/4!+$--------
16. Write a program to generate Pascal Triangle.
17. Write a program to read two matrices and print their sum and product in the matrix form.
18. Write a program to read matrix and perform the following operations.
    i. Find the sum of Diagonal Elements of a matrix.
    ii. Print Transpose of a matrix.
    iii. Print sum of even and odd numbers in a given matrix.
19. Write a program to accept a line of characters and print the count of the number of Vowels, Consonants, blank spaces, digits and special characters.
20. Write a program to insert a substring in to a given string and delete few characters from the string. Don't use library functions related to strings.
21. Write a program to perform the operations addition, subtraction, multiplication of complex numbers.
22. Write a program to split a 'file' in to two files, say file1 and file2. Read lines into the 'file' from standard input. File1 should consist of odd numbered lines and file2 should consist of even numbered lines.

23. Write a program to merge two files.
24. Write a program to implement numerical methods Lagrange's interpolation, Trapezoidal rule.
25. Write a program to read a set of strings and sort them in alphabetical order.
26. Write a program to sort the elements of an array using sorting by exchange.
27. Write a program to sort the elements of an array using Selection Sort.
28. Write a program to perform Linear Search on the elements of a given array.
29. Write a program to perform Binary Search on the elements of a given array.
30. Write a program to find the number of occurrences of each number in a given array of numbers.
31. Write a program to read two strings and perform the following operations without using built-in string Library functions and by using your own implementations of functions.
    i. String length determination ii .Compare Two Strings
    iii. Concatenate them, if they are not equal iv. String reversing
32. Write programs using recursion for Factorial of a number, GCD, LCM, Towers of Hanoi.
33. Write a program to convert infix expression to postfix expression and evaluate postfix expression.
34. Write a program to exchange two numbers using pointers.
35. Write a program to implement stack, queue, circular queue using array and linked lists.
36. Write a program to perform the operations creation, insertion, deletion, and traversing a singly linked list
37. Write a program to read student records into a file. Record consists of rollno, name and marks of a student in six subjects and class. Class field is empty initially. Compute the class of a student. The calculation of the class is as per JNTUA rules. Write the first class, second class, third class and failed students lists separately to another file.
38. A file consists of information about employee salary with fields employeeid, name, Basic, HRA, DA, IT, other-deductions, Gross and Net salary. Initially only employeeid, name, and basic have valid values. HRA is taken as 10% of the basic, DA is taken as 80% of basic, IT is 20% of the basic, other deductions is user specified. Compute the Gross and Net salary of the employee and update the file.
39. Write a program to perform Base (decimal, octal, hexadecimal, etc) conversion.
40. Write a program to find the square root of a number without using built-in library function.
41. Write a program to convert from string to number.
42. Write a program to generate pseudo random generator.
43. Write a program to remove duplicates from ordered and unordered arrays.
44. Write a program to sort numbers using insertion sort.
45. Write a program to implement quick sort using non-recursive and recursive approaches. Use randomized element as partitioning element.
46. Write a program to search a word in a given file and display all its positions.
47. Write a program to generate multiplication tables from 11 to 20.
48. Write a program to express a four digit number in words. For example 1546 should be written as one thousand five hundred and forty six.
49. Write a program to generate a telephone bill. The contents of it and the rate calculation etc should be as per BSNL rules. Student is expected to gather the required information through the BSNL website.
50. Write a program for tic-tac-toe game.
51. Write a program to find the execution time of a program.
52. Design a file format to store a person's name, address, and other information. Write a program to read this file and produce a set of mailing labels

***Note**: The above list consists of only sample programs. Instructors may choose other programs to illustrate certain concepts, wherever is necessary. Programs should be there on all the concepts studied in the Theory on C programming and Data structures. Instructors are advised to change atleast 25% of the programs every year until the next syllabus revision.*

References:

1. *"Programming with C", Byron Gottfried, Third Edition, Schaum's Outlines, Mc Graw Hill.*
2. *"Fundamentals of Data Structures in C", Horowitz, Sahni, Anderson-freed, Second Edition, Universities Press.*
3. *"How to Solve it by Computer", R.G. Dromey, Pearson.*
4. *"The C Programming Language", Brian W. Kernighan, Dennis M. Ritchie, Pearson.*
5. *"Classic Data Structures", Samantha, PHI*
6. *"Let us C", Yeswant Kanetkar, BPB publications*
7. *"Pointers in C", Yeswant Kanetkar, BPB publications*

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Common to All Branches
(13A99102) ENGINEERING PHYSICS & ENGINEERING CHEMISTRY LAB

ENGINEERING PHYSICS LAB

LIST OF EXPERIMENTS

Any 10 of the following experiments has to be performed:

1. Determination of wavelengths of various colours of mercury spectrum using diffraction grating in normal incidence method
2. Determination of dispersive power of the prism
3. Determination of thickness of thin object by wedge method
4. Determination of radius of curvature of lens by Newton's Rings
5. Laser : Diffraction due to single slit
6. Laser : Diffraction due to double slit
7. Laser: Determination of wavelength using diffraction grating
8. Determination of Numerical aperture of an optical fiber
9. Meldes experiment: Determination of the frequency of tuning fork
10. Sonometer: Verification of the three laws of stretched strings
11. Energy gap of a material using p-n junction diode
12. Electrical conductivity by four probe method
13. Determination of thermistor coefficients (α, β)
14. Hall effect : Determination of mobility of charge carriers in semiconductor
15. B-H curve
16. Magnetic field along the axis of a current carrying coil – Stewart and Gee's method.
17. Determination of lattice constant using X-ray spectrum.

ENGINEERING CHEMISTRY LAB

Preamble:

The experiments are designed in a manner that the students can validate their own theory understanding in chemistry by self involvement and practical execution. Thus the execution of these experiments by the student will reinforce his/her understanding of the subject and also provide opportunity to refine their understanding of conceptual aspects. As a result, the student gets an opportunity to have feel good factor at the laboratory bench about the chemical principles that he/she learned in the classroom.

***Course Objective**:*

- *Will learn practical understanding of the redox reaction*
- *Will able to understand the function of fuel cells, batteries and extend the knowledge to the processes of corrosion and its prevention*
- *Will learn the preparation and properties of synthetic polymers and other material that would provide sufficient impetus to engineer these to suit diverse applications*
- *Will also learn the hygiene aspects of water would be in a position to design methods to produce potable water using modern technology*

Learning Outcome:

- *Would be confident in handling energy storage systems and would be able combat chemical corrosion*
- *Would have acquired the practical skill to handle the analytical methods with confidence.*
- *Would feel comfortable to think of design materials with the requisite properties*
- *Would be in a position to technically address the water related problems.*

LIST OF EXPERIMENTS

Any 10 of the following experiments has to be performed:

1. Determination of total hardness of water by EDTA method.
2. Determination of Copper by EDTA method.
3. Estimation of Dissolved Oxygen by Winkler's method
4. Determination of Copper by Iodometry
5. Estimation of iron (II) using diphenylamine indicator (Dichrometry – Internal indicator method).
6. Determination of Alkalinity of Water
7. Determination of acidity of Water
8. Preparation of Phenol-Formaldehyde (Bakelite)
9. Determination of Viscosity of oils using Redwood Viscometer I
10. Determination of Viscosity of oils using Redwood Viscometer II
11. Conductometric titration of strong acid Vs strong base (Neutralization titration).
12. Conductometric titration of Barium Chloride vs Sodium Sulphate (Precipitation Titration)
13. Determination of Corrosion rate and inhibition efficiency of an inhibitor for mild steel in hydrochloric acid medium.
14. Estimation of Chloride ion using potassium Chromite indicator (Mohrs method)

References:

1. *Vogel's Text book of Quantitative Chemical Analysis, J. Mendham et al, Pearson Education, Sixth Edition, 2012.*
2. *Chemistry Practical – Lab Manual by K.B.Chandra Sekhar, G.V. Subba Reddy and K.N.Jayaveera, SM Publications, Hyderabad, 3rd Edition, 2012.*

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B.Tech. I Year	**L**	**C**
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Common to All Branches
(13A99103) ENGINEERING & I.T. WORKSHOP

ENGINEERING WORKSHOP

Course Objective:
The budding Engineer may turn out to be a technologist, scientist, entrepreneur, practitioner, consultant etc. There is a need to equip the engineer with the knowledge of common and newer engineering materials as well as shop practices to fabricate, manufacture or work with materials. Essentially he should know the labour involved, machinery or equipment necessary, time required to fabricate and also should be able to estimate the cost of the product or job work. Hence engineering work shop practice is included to introduce some common shop practices and on hand experience to appreciate the use of skill, tools, equipment and general practices to all the engineering students.

1. TRADES FOR EXERCISES:

a. Carpentry shop– Two joints (exercises) involving tenon and mortising, groove and tongue: Making middle lap T joint, cross lap joint, mortise and tenon T joint, Bridle T joint from out of 300 x 40 x 25 mm soft wood stock
b. Fitting shop– Two joints (exercises) from: square joint, V joint, half round joint or dove tail joint out of 100 x 50 x 5 mm M.S. stock
c. Sheet metal shop– Two jobs (exercises) from: Tray, cylinder, hopper or funnel from out of 22 or 20 guage G.I. sheet
d. House-wiring– Two jobs (exercises) from: wiring for ceiling rose and two lamps (bulbs) with independent switch controls with or without looping, wiring for stair case lamp, wiring for a water pump with single phase starter.
e. Foundry– Preparation of two moulds (exercises): for a single pattern and a double pattern.
f. Welding – Preparation of two welds (exercises): single V butt joint, lap joint, double V butt joint or T fillet joint.

2. TRADES FOR DEMONSTRATION:

a. Plumbing
b. Machine Shop
c. Metal Cutting

Apart from the above the shop rooms should display charts, layouts, figures, circuits, hand tools, hand machines, models of jobs, materials with names such as different woods, wood faults, Plastics, steels, meters, gauges, equipment, CD or DVD displays, First aid, shop safety etc. (though they may not be used for the exercises but they give valuable information to the student). In the class work or in the examination knowledge of all shop practices may be stressed upon rather than skill acquired in making the job.

References:

1. *Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd., 2009*
2. *Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.*
3. *Engineering Practices Lab Manual, Jeyapoovan, SaravanaPandian, 4/e Vikas*
4. *Dictionary of Mechanical Engineering, GHF Nayler, Jaico Publishing House.*

I.T. WORKSHOP

Course Objective:

- *To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations*
- *To make the students know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system*
- *To learn about Networking of computers and use Internet facility for Browsing and Searching.*

Learning Outcome:

- *Disassemble and Assemble a Personal Computer and prepare the computer ready to use.*
- *Prepare the Documents using Word processors*
- *Prepare Slide presentations using the presentation tool*
- *Interconnect two or more computers for information sharing*
- *Access the Internet and Browse it to obtain the required information*
- *Install single or dual operating systems on computer*

Preparing your Computer (5 weeks)

Task 1: Learn about Computer: *Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.*

Task 2: Assembling a Computer: *Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer.*

Task 3: Install Operating system: *Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.*

Task 4*:* ***Operating system features****: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.*

Networking and Internet (4 weeks)

Task 5: Networking*: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc should be done by the student. The entire process has to be documented.*

Task 6: Browsing Internet*: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc.*

If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating e-mail account.

Task 7: Antivirus: *Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.*

Productivity tools (6 weeks)

Task 8: Word Processor: *Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines,*

Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered.

Task 9: Spreadsheet: *Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.*

Task 10: Presentations : *creating, opening, saving and running the presentations, Selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.*

Optional Tasks*:*
Task 11: Laboratory Equipment*: Students may submit a report on specifications of various equipment that may be used by them for the laboratories in their curriculum starting from I B.Tech to IV. B.Tech. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.*

- *Desktop computer*
- *Server computer*
- *Switch (computer science related)*
- *Microprocessor kit*
- *Micro controller kit*
- *Lathe machine*
- *Generators*
- *Construction material*
- *Air conditioner*
- *UPS and Inverter*
- *RO system*
- *Electrical Rectifier*
- *CRO*
- *Function Generator*
- *Microwave benches*

Task 12: Software*: Students may submit a report on specifications of various software that may be used by them for the laboratories in their curriculum starting from I B.Tech to IV. B.Tech. The software may be proprietary software or Free and Open source software. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.*

- *Desktop operating system*
- *Server operating system*
- *Antivirus software*
- *MATLAB*
- *CAD/CAM software*
- *AUTOCAD*

References:

1. *Introduction to Computers, Peter Norton, Mc Graw Hill*
2. *MOS study guide for word, Excel, Powerpoint & Outlook Exams", Joan Lambert, Joyce Cox, PHI.*
3. *Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.*
4. *Networking your computers and devices, Rusen, PHI*
5. *Trouble shooting, Maintaining & Repairing PCs", Bigelows, TMH*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. I Year	**L**	**C**
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Common to All Branches

(13A52102) ENGLISH LANGUAGE COMMUNICATION SKILLS (ELCS) LAB

The Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

Course Objective:

- *To train students to use language effectively in everyday conversations.*
- *To expose the students to a varied blend of self-instructional learner-friendly modes of language learning through computer-aided multi-media instruction.*
- *To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.*
- *To help the second language learners to acquire fluency in spoken English and neutralize mother tongue influence*
- *To train students to use language appropriately for interviews, group discussion and public speaking*

Learning Outcome:

- *Becoming active participants in the learning process and acquiring proficiency in spoken English of the students*
- *Speaking with clarity and confidence thereby enhancing employability skills of the students*

PHONETICS
Importance of speaking phonetically correct English
Speech mechanism-Organs of speech
Uttering letters-Production of vowels sounds
Uttering letters -Production of consonant sounds
Uttering words-Stress on words and stress rules
Uttering sentences-Intonation-tone group
LISTENING
Listening as a skill
Listening activities
PRESENTATIONAL SKILLS
Preparation
Prepared speech
Impromptu speech
topic originative techniques
JAM (Just A Minute)
Describing people/object/place
Presentation-
Stage dynamics
Body language
SPEAKING SKILLS
Telephone skills
Role plays
Public Speaking
GROUP ACTIVITIES
Debates
Situational dialogues

MINIMUM REQUIREMENT FOR ELCS LAB:

The English Language Lab shall have two parts:

Computer Assisted Language Learning (CALL) Lab:

- The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.
- The Communication Skills Lab with movable chairs and audio-visual aids with a P.A. system, Projector, a digital stereo-audio & video system and camcorder etc.

System Requirement (Hardware component):

- Computer network with LAN with minimum 60 multimedia systems with the following specifications:
  - P – IV Processor
  - Speed – 2.8 GHZ
  - RAM – 512 MB Minimum
  - Hard Disk – 80 GB
  - Headphones of High quality

SUGGESTED SOFTWARE:

- Clarity Pronunciation Power – Part I (Sky Pronunciation)
- Clarity Pronunciation Power – part II
- K-Van Advanced Communication Skills
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- *DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.*
- Lingua TOEFL CBT Insider, by Dreamtech
- English Pronunciation in Use (Elementary, Intermediate, Advanced) CUP
- Cambridge Advanced Learners' English Dictionary with CD.
- Oxford Advanced Learner's Compass, 8th Edition
- Communication Skills, Sanjay Kumar & Pushp Lata. 2011. OUP

References:

1. *Strengthen Your Steps, Maruthi Publicaions, 2012.*
2. *A Course in Phonetics and Spoken English, Dhamija Sethi, Prentice-Hall of India Pvt.Ltd.*
3. *A Textbook of English Phonetics for Indian Students 2nd Ed T. Balasubramanian. (Macmillian),2012.*
4. *Speaking English Effectively, 2nd Edition Krishna Mohan & NP Singh, 2011. (Mcmillan).*
5. *Listening in the Language Classroom, John Field (Cambridge Language Teaching Library),2011*
6. *A Hand Book for English Laboratories, E.Suresh Kumar, P.Sreehari, Foundation Books,2011*
7. *English Pronunciation in Use. Intermediate & Advanced, Hancock, M. 2009. CUP.*
8. *Basics of Communication in English, Soundararaj, Francis. 2012.. New Delhi: Macmillan*
9. *Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.*
10. *English Pronouncing Dictionary, Daniel Jones, Current Edition with CD.Cambridge, 17th edition, 2011.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. II - I Sem.	Th	Tu	C
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(13A54301) MATHEMATICS – II

Course Objective:

- *This course aims at providing the student with the concepts of Matrices, Fourier series, Fourier transforms and partial differential equations which find the applications in engineering.*
- *Our emphasis will be more on the logical and problem solving development in the Numerical methods and its applications.*

Learning Outcome:

- *The student becomes familiar with the application of Mathematical techniques like Fourier series and Fourier transforms.*
- *The student gains the knowledge to tackle the engineering problems using the concepts of Partial differential equations and Numerical methods.*

UNIT I

Rank – Echelon form, normal form – Consistency of System of Linear equations. Linear transformations Complex Matrices:- Hermitian, Skew-Hermitian and Unitary matrices and their properties. Eigen Values, Eigen vectors for both real and complex matrices. Cayley – Hamilton Theorem and its applications – Diagonolization of matrix. Calculation of powers of matrix. Quadratic forms – Reduction of quadratic form to canonical form and their nature.

UNIT II

Solution of Algebraic and Transcendental Equations: Introduction – The Method of False Position – Newton-Raphson Method.

Interpolation:-Introduction – Newton's forward and backward interpolation formulae – Lagrange's Interpolation formula.

Curve fitting: Fitting a straight line – Second degree curve – Exponentional curve-Power curve by method of least squares.

UNIT III

Numerical Differentiation and Integration – Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Method – Predictor-Corrector Method – Milne's Method.

UNIT IV

Fourier Series: Determination of Fourier coefficients – Fourier series – Even and odd functions – Fourier series in an arbitrary interval – Even and odd period, continuation – Half-range Fourier sine and cosine expansions.

Fourier integral theorem – Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.

UNIT V

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Method of separation of variables – Solutions of one dimensional wave equation, heat equation and two-dimensional Laplace's equation under initial and boundary conditions.

Text Books:

1. *Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.*
2. *Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher.*

Reference Books:

1. *Engineering Mathematics, Volume - II, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.*
2. *Engineering Mathematics, Volume - II, by G.S.S.Raju, CENGAGE publisher.*
3. *Mathematical Methods by T.K.V. Iyengar, S. Chand publication.*
4. *Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.*
5. *Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.*

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(13A01308) MECHANICS OF SOLIDS

Course Objective:
The objective of the subject is to learn the fundamental concepts of stress, strain and deformation of solids with applications to bars and beams. The students shall understand the theory of elasticity including strain/displacement and hooks law relationships. To accesses stresses and deformations through the mathematical models of beams for bending and bars for twisting or combination of both. The knowledge of this subject will help in the design & Theory of machines courses.

UNIT I

SIMPLE STRESSES & STRAINS: Elasticity and plasticity – Types of stresses & strains – Hooke's law – stress & strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings. Principle stresses and strains-computation of principle stresses and strains on inclined planes-theory of failures- minimum principle stress, strain, shear stress and strain energy theories.

Learning Outcome & Suggested Student Activities:
This unit gives the student how to measure the strength of materials based on calculating stresses, strains and deformations for basic geometries subjected to axial loading and thermal effects. Students are advised to visit the URL http://nptel.iitm.ac.in/courses/IIT-MADRAS/Strength_of_Materials/Pdfs/1_1.pdf.

UNIT II

SHEAR FORCE AND BENDING MOMENT : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

Learning outcome & Suggested Student Activities:
This unit gives awareness for the students how to draw shear force and bending moment diagrams for calculating maximum shear force and maximum bending moment for different types of beams with different lateral loadings conditions. This topic can be downloaded from the URL http://vedyadhara.ignou.ac.in/wiki/images/a/ad/BME-017_B-1(Unit_4).pdf

UNIT III

FLEXURAL STRESSES: Theory of simple bending – Assumptions – Derivation of bending equation: M/ I = f/y = E/R Neutral axis –Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I , T angle sections.

Learning outcome & Suggested Student Activities:
This unit gives knowledge to the students about the strength of the beams with different sections by bringing the relationship between the bending stress and maximum bending moment, bringing the relationship between the shear stress and maximum shear force which are calculated from previous unit. This topic can be downloaded from the following URL http://web.mit.edu/emech/dontindex-build/full-text/emechbk_7.pdf.

UNIT IV

TORSION OF CIRCULAR SHAFTS- Theory of pure torsion- Derivation of torsion equations; $T/J=q/r=N\theta/L$ – Assumptions made in the theory of pure torsion- torsional moment of resistance- polar section modulus.

DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point

loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

Learning outcome & Suggested Student Activities:

This unit gives awareness to the students how to calculate the shear strength of the solid and hallow shafts which are subjected to torsional loading in power transmitting. This topic related to torsion can be download from the following URLs
http://www.mae.ncsu.edu/zhu/courses/mae314/lecture/Lecture4_Torsion.pdf, and also gives better knowledge for students how to calculate deflections of beam using different methods under different boundary and loading conditions. Notes for this topic can be download from the web site http://nptel.iitm.ac.in/courses/IIT-MADRAS/Strength_of_Materials/Pdfs/5_1.pdf.

UNIT V

THIN CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in diameter, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.

THICK CYLINDERS: Lame's equation – cylinders subjected to inside & outside pressure - compound cylinders.

Learning outcome & Suggested Student Activities:

This unit gives application to mechanics of solids for students in which how to calculate different stresses and strains for the thin and thick cylinders in identifying safe design for boiler shells and thick shells as such in like domestic cylinders, air compressor and high pressure vessels used in thermal plants etc. Notes for this topic can be download from the site
http://www.ewp.rpi.edu/hartford/users/papers/engr/ernesto/poworp/Project/4.%20Supporting_Material/Books/32658_09 & 10.pdf.

Text Books:

1. *Mechanics of Materials by Gere and Timoshenko, C B S Publishers & Distributors, 2nd Edition,2004.*
2. *Strength of Materials by R.K. Bansal, Laxmi Publishers, 5th Edition,2012.*

Reference Books:

1. *Strength of Materials by S. Ramamrutham, Dhanpat Rai Publishers*
2. *Strength of Materials by R.K. Rajput, S.Chand& Company, 5th Edition,2012.*
3. *Strength of Materials by Dr. Sadhu Singh, Khanna Publishers, 10th Edition,2013.*
4. *Strength of Materials by M.Chakraborti, S.K.Kataria& Sons, 2nd Edition,2011.*
5. *Strength of Materials by S S Rattan, The McGraw-Hill Companies, 2nd Editon,2011.*

Suggestions:

- *Students are advised to buy a text book for understanding problems then they may buy Strength of materials by R.K.Bansal, Laxmi Publishers& For further more problems Strength of Materials by R.K. Rajput, S.Chand& Company*
- *Students may go around some of the small scale industries and domestic orientated jobs gives better knowledge on to check strength of materials.*
- *Some basic knowledge regarding Engineering mechanics, Mathematics and Physics are required for understanding this subject.*

Web Resources:

http://nptel.iitm.ac.in/
www.learnerstv.com/Free-Engineering-video-lecture-courses.htm
http://en.wikibooks.org/wiki/Strength_of_Materials

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B.Tech. II - I Sem.	**Th**	**Tu**	**C**
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(13A99302) ELECTRICAL AND ELECTRONICS ENGINEERING

PART – A ELECTRICAL ENGINEERING

Course Objective:

- *In this course the different types of DC generators and motors, Transformers, 3 Phase AC Machines which are widely used in industry are covered and their performance aspects will be studied.*

UNIT I DC MACHINES

D.C.GENERATOR: Principles of Operation –Constructional Details-Expression for Generated Emf-Types of Generators-Losses in D.C.Generator – Characteristics of D.C.Generators-Applications of D.C.Generators.

D.C. MOTOR: Principles of Operation –Constructional Details-Back EMF-Types of Motors-Armature Torque of a D.C. Motor - Characteristics of D.C.Motors -Applications of D.C.Motors-3 Point Starter-Speed Control of Shunt Motors

UNIT II TRANSFORMERS

Principles of Operation- Constructional Details- Types of Transformers- Emf Equation of a Transformer –Voltage Transformation Ratio-Equivalent Circuit- Equivalent Resistance- Equivalent Reactance-Losses in the Transformer-Copper Loss, Iron Loss-Transformer Tests-Open Circuit, Short Circuit Test-Efficiency of a Transformer –Regulation of Transformer

UNIT III 3 PHASE AC MACHINES

INDUCTION MACHINES:

Introduction to 3-Phase Induction Motor- Principle of Operation- Constructional Details-Slip, Frequency of Rotor Current-Expression for Torque -Torque-Slip Characteristics- Applications of 3 Phase Induction Motors

ALTERNATORS:

Principle of Operation-Constructional Details-EMF Equation-Voltage Regulation by Synchronous Impedance Method

Text Books:

1. *Basic Electrical Engineering by D P KOTHARI & I J NAGRATH, Tata McGraw Hill, Second Edition, 2007.*
2. *Electrical Circuit Theory and Technology by JOHN BIRD, Routledge publisher, 4Th Edition, 2011.*

Reference Books:

1. *Electrical & Electronic Technology by Edward Hughes, 10th Edition, Pearson, 2008.*

PART – B ELECTRONICS ENGINEERING

UNIT I

SEMICONDUCTOR DEVICES: Intrinsic semiconductors-Electron-Hole Pair Generation, Conduction in Intrinsic Semiconductors, Extrinsic Semiconductors-N-Type and P-Type Semiconductors, Comparison of N-Type and P-Type Semiconductors. The p-n Junction - Drift and Diffusion Currents, The p-n Junction Diode-Forward Bias, Reverse Bias, Volt-Ampere Characteristics- Diode Specifications, Applications of Diode, Diode as a Switch. Diode as a Rectifier-Half-wave Rectifier, Full-Wave Rectifier, Full-Wave Bridge Rectifier, Rectifiers with Filters, Zener Diode- Volt-Ampere Characteristics, Zener Diode as Voltage Regulator. Silicon Controlled Rectifier- Two Transistor Analogy of an SCR, Characteristics, Applications of SCR, DIAC, TRIAC.

UNIT II

BJT and FETs: Bipolar Junction Transistor (BJT) – Types of Transistors, Operation of NPN and PNP Transistors, Input-Output Characteristics of BJT-CB, CE and CC Configurations, Relation between $I_{C,}$ I_B and I_E. Transistor Biasing- Fixed Bias, Voltage Divider Bias, Transistor Applications- Transistor as an Amplifier, Transistor as a Switch,. Junction Field Effect Transistor (JFET)- Theory and Operation of JFET, Output Characteristics, Transfer Characteristics, Configurations of JFET-CD, CS and CG Configurations, JFET Applications- JFET as an Amplifier, JFET as a Switch, Comparison of BJT and JFET,MOSFET-The Enhancement and Depletion MOSFET, Static Characteristics of MOSFET, Applications of MOSFET.

UNIT III

DIGITAL ELECTRONICS: Number Systems-Decimal System, Binary System, Octal System, Hexadecimal System, Code Conversions, Binary Arithmetic- Binary Addition, Binary Subtraction, Logic Gates and Truth Tables-NOT, OR, AND, EX-OR, EX-NOR, Universal Gates- NAND, NOR Gates. Boolean algebra and De Morgan's Theorems, Combinational Circuits-Adders and Subtractors.

Text Books:

1. Basic Electrical and Electronics Engineering, M.S.Sukhija, T.K.Nagsarkar, Oxford University Press, 1st Edition, 2012.

2. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012.

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B.Tech. II - I Sem.	**Th**	**Tu**	**C**
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(13A03301) MATERIAL SCIENCE AND ENGINEERING

Course Objective:
To gain and understanding of the relationship between the structure, properties, processing, testing, heat treatment and applications of metallic , non metallic, ceramic and composite materials so as to identify and select suitable materials for various engineering applications.

UNIT I

STRUCTURE OF METALS: Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size.
CONSTITUTION OF ALLOYS: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

Learning outcome & Suggested Student Activities:
Students will get knowledge on bonds of solids and knowing the crystallization of metals. By knowing the grain size and shape through the crystallization, he may understand the effect of grain boundaries on the properties of metals and finally he determines the grain size that is very essential for analyzing the microstructures of metals.
Students are advised to refer the following websites www.physics.rutgers.edu/meis/pubs/BB_thesis.pdf www.ce.berkeley.edu/~paulmont/CE60New/alloys-steel.pdf for better understanding of this topic.

UNIT II

EQUILIBRIUM OF DIAGRAMS: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, and Fe-Fe_3C

Learning outcome & Suggested Student Activities:
Students will be able to construct the equilibrium diagrams by experimental methods and knowing all types of equilibrium diagrams isomorphs alloy systems , electric systems, pertectic systems solid-state transformations etc. while studying all these diagrams he may able to know about lever rule and phase rule.
Students are advised to visit the following URLs website www.freelance-teacher.com/videos.htm www.susqu.edu/brake/aux/downloads/papers/foamcomp.pdf for better understanding of this topic.

UNIT III

CAST IRONS AND STEELS: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.
NON-FERROUS METALS AND ALLOYS: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

Learning Outcome &Suggested Student Activities:
Students will be able to learn the structure and properties of all cast irons, steels and Non-ferrous metal alloys of copper, Al and Titanium. Students are advised to visit any Machine shop in the industries like SAIL, Visakhapatnam steel plant etc.,Students are advised to visit the following website.www.buzzle.com, www.mhprofessional.comwww.eng.sut.ac for better understanding of this topic.

UNIT IV

HEAT TREATMENT OF ALLOYS: Effect of alloying elements on Iron – Iron carbon system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys. Heat treatment of plastics

Learning outcome & Suggested Student Activities:

Students will be able to learn the methods of different heat treatments i.e. annealing, normalizing and hardening. He also learns the different of alloying elements on Iron-Iron carbon system, the importance of TTT diagrams, Harden ability that are very essential for melting science. Finally, he learn about the heat treatment of cryogenic environment as an advance topic.

Students are advised to go through the URLs http://www.nptel.iitm.ac.in/and iisc.ernet.in for video lectures,http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv180-Page1.htm

UNIT V

CERAMIC MATERIALS: Crystalline ceramics, glasses, cermets.

COMPOSITE MATERIALS: Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, polymer composites, metal ceramic mixtures, metal – matrix composites and Carbon – Carbon composites.

Learning Outcome & Suggested Student Activities:

This unit helps the students to understand the importance of advanced composite materials in application to sophisticated machine and structure of components, These composite materials helps to develop the components with required properties which we cannot attain using the metals & metal alloys.

Examples of products maybe of composite materials are air cooler bodies, fiber reinforced hose pipes, boat bodies some automobile body frames etc. Students may refer the following website for better understanding www.susqu.edu/brake/aux/downloads/papers/foamcomp.pdf; .Asmenternation.orgwww.princeton.edu/~achaney/tmve/wiki100k/doc/metal_matrix_composite.html

Text Books:

1. *Introduction to Physical Metallurgy, Sidney H. Avner, US, 2nd Edition, 2007 Tata McGraw-Hill, Noida, 1985.*
2. *Essential of Materials Science and Engineering, Donald R.Askeland, USA, 3rd Edition, Cengage Publisher,2013.*

Reference Books:

1. *Material Science and Metallurgy, U.C. Jindal, pearson educations, 2011,*
2. *Elements of Materials Science and Engineering, Lawrance H. Van Vlack, pearson educations, 6th Edition,2002.*
3. *Material Science and Metallurgy, kodgire V.D, 12th Edition, Everest Publishing House,2002.*
4. *Engineering Mechanics of Composite Materials- Isaac and M Daniel, Oxford University Press, 1994, 2nd Edition 2013.*
5. *Mechanics of Composite Materials, R. M. Jones, McGraw Hill Company, New York, 1975.*
6. *Science of Engineering Materials, Agarwal, TMH.*
7. *Materials Science and Engineering, William D. Callister, 8th Edition,2010.*
8. *Elements of Material science, V. Rahghavan, PHI, 5th Editon.*
9. *Engineering Materials and Their Applications – R. A Flinn and P K Trojan, Jaico Books.*
10. *Engineering materials and metallurgy, R.K.Rajput, S.Chand, 1st Editon,2008.*

Web References:

www.asminternational.org
www.henry.wells.edu
www.ce.berkeley.edu
www.sjsu.edu

Note: Separate Answer Booklets should be supplied

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B.Tech. II - I Sem.	Th	Tu	C
	3	1	3

(13A03302) THERMODYNAMICS

Course Objective:
By this subject students will get the awareness on basic thermodynamic principles, skills to perform the analysis and design of thermodynamic systems, First law and second law of thermodynamics and its applications to a wide variety of systems, principles of psychrometry and properties of pure substances. And also understand the concept of various air standard cycles with the help of P-v and T-s Diagrams.

UNIT I

BASIC CONCEPTS: Macroscopic and Microscopic Approaches, Thermodynamic System, State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium, Quasi-static Process, Zeroth Law of Thermodynamics,

WORK & HEAT TRANSFER: Work transfer, types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

Learning Outcome & Suggested Student Activities:
Students can able to understand thermodynamic property, cycle, constraints of equilibrium, reversibility and energy transfer in the form of Work and Heat with various applications. Students are advised to collect different types of thermometers, measure the temperature of a given room/substance and compare the values. Following URL is very useful for better understanding http://www.nptel.iitm.ac.in. Students may refer text book of Fundamentals of Engineering Thermodynamics By Michael J. Moran, Howard N. Shapiro.

UNIT II

FIRST LAW OF THERMODYNAMICS: First Law applied to a process and a cycle, Energy - a property, Forms and transformation of Energy, Internal Energy and Enthalpy, PMM I.

FLOW SYSTEMS: Control Volume, Steady Flow Process, Mass balance and Energy Balance, Applications of Steady Flow Processes.

Learning Outcome & Suggested Student Activities:
Student will learn how energy transformation occurs from one form into another form in open and closed systems and applying steady flow energy equation and mass balance equation to various applications.
Student is advised to observe the Nozzle, Diffuser, Throttling device, Turbine and compressor in laboratories or local industries and understand their working principles practically. Notes of First law of thermodynamics can be downloaded from the website http://nptel.iitm.ac.in/courses/103101004/downloads/chapter-3.pdf.

UNIT III

Second Law of Thermodynamics: Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, Carnot cycle and Carnot's Theorem, Thermodynamic Temperature Scale, Efficiency of Heat Engine, PMM II

Entropy: Clausius' Theorem, Entropy as a property, T-s Plot, Clausius Inequality, Principle of Entropy Increase and its applications. Available Energy, Quality of Energy, definitions of Dead state, Availability.

Learning Outcome & Suggested Student Activities:
Student will identify the major difference in working of a heat engine, refrigerator and heat pump. to calculate the maximum efficiency of a cycle. Also student can learn calculating entropy change for a process, maximum available energy. Student is advised to visit laboratories of Heat Engines, Refrigeration and Air conditioning and observe how they work. Student may refer text book Fundamentals of Classical Thermodynamics - G.J.VanWylen& Sonntag

UNIT IV

Pure Substances: P-v, P-T, T-s diagrams of Pure Substances, Mollier Diagram, Dryness Fraction, Use of Steam Tables for Thermodynamic Properties

Thermodynamic Relations: Maxwell's equations, TDS equations, Joule-Kelvin Effect, Clausius-clapeyron equation.

Learning Outcome & Suggested Student Activities:

After the completion of the unit, student will be able to understand the method drawing phase equilibrium diagrams like P-v, h-s, T-s and P-T of a pure substance. Student can learn the usage of steam tables and mollier diagrams in solving problems. Also, the student will learn the cooling / heating effect of throttling process. Thermodynamic relations.

Student is advised to do the experiment on water (To cool / heat water) from atmospheric conditions and observe freezing / boiling point temperatures, changes in volume etc. Repeat the same experiment under different pressure.

UNIT V

Properties of Gases and Gas Mixtures: Ideal Gas, Equation of State, Avogadro's Law, Internal Energy and Enthalpy of Ideal Gas, Entropy Change of Ideal Gas, Mixture of Gases- Dalton's Law of Partial Pressure , Specific Heats, Internal Energy and Enthalpy of Gas Mixtures

Gas Power Cycles: Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, their applications, comparison of Otto, Diesel and Dual cycles, Second Law Analysis of Gas Power Cycles

Learning Outcome & Suggested Student Activities:

Student will learn basic laws of ideal gas and gas mixtures. After studying Gas Power Cycles, student will understand the concept of ideal cycles for different engines and their working principle. Student can know drawing P-V and T-S diagrams for various air standard cycles and calculating work output, efficiency, mean effective pressure of each cycle.

Student is advised to conduct experiments in I.C Engines lab to find out the actual thermal efficiencies of Diesel and Petrol Engines and compare them with respect to ideal cycles.

Text Books:

1. *Engineering Thermodynamics, P.K Nag, TMH Publishers, New Delhi, 5th Edition,2013.*

Reference Books:

1. *Engineering Thermodynamics by P. Chattopadhyam, Oxford,1st Revised ,2011.*
2. *Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen, John Wiley & sons (ASIA) Pte Ltd, 7th Edition, 2009.*
3. *Thermodynamics – An Engineering Approach – YunusCengel& Boles, TMH,7th Edition 2011.*
4. *Thermodynamics – J.P.Holman, McGrawHill, 2nd Edition company New York 1975.*
5. *An introduction to Thermodynamics, YVC Rao, Universities press, 2009 Revised Edition,*
6. *Engineering Thermodynamics – J.B. Jones & R.E.Dugan, PHI ,1st Edition, 2009.*

NOTE: *Steam tables, Mollier Diagrams should be supplied*

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B.Tech. II - I Sem.	**Drg**	**C**
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(13A03303) MACHINE DRAWING

Course Objective:
To make the students to understand the concepts of I.S. conventions, methods of dimensioning, the title boxes, to draw the machine elements and simple parts.
To make the students to understand and draw assemblies of machine parts and to draw their sectional views

UNIT I

Machine Drawing Conventions: Need for drawing conventions- introduction to IS conventions
Conventional representation of material, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs. Parts not usually sectioned.
Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
Title boxes, their size, location and details-common abbreviations & their liberal usage

Learning Outcome & Suggested Student Activities:
This unit is useful to prepare the students for representing their ideas at International standards and will be able to convey in without much effort globally with ease. Students will acquire skills to draft on a drawing sheet without much effect. Students are advised to visit machine shop.

UNIT II

Drawing of Machine Elements and simple parts: Selection of Views, additional views for the following machine elements and parts with drawing proportions:
Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws,Keys, cottered joints and knuckle joint, Rivetted joints for plates, flanged &protected flanged joint.Shaft coupling, spigot and socket pipe joint.Journal, and foot step bearings.

Learning Outcome & Suggested Student Activities:
Students can represent various details of an object quickly without much time and ambiguity. These drawings can be easily prepared and understood by both the people in a manufacturing industry and the consumers too. Students are advised to visit machine shop.

UNIT III

Assembly Drawings: Drawings of assembled views for the part drawings of the following.
Engine parts- stuffing boxes, cross heads, Eccentrics, Petrol Engine-connecting rod, piston assembly.
Other machine parts- Screw jack, Machine Vice, single tool post.
Valves: Steam stop valve, feed check valve. Non return value.

Learning Outcome & Suggested Student Activities:
Students can understand the working principles of an assembly or subassembly so that he/she will be able to produce the final product by procuring the units from various sources/suppliers and still produce any useful product serving effectively. It is not necessary that all the components to be made locally only. Students are advised to visit body building and assembly unit.

Note: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

Text Books:

1. *Machine Drawing- K.L. Narayana, P.Kannaiah & K.Venkata Reddy, New Age Publishers, 4th Edition, 2012.*
2. *Machine Drawing- Dhawan, S.Chand Publications, 1st Revised Edition,1998.*

Reference Books:

1. *Machine Drawing- P.S. Gill, S.K. Kataria & Sons, 17th Edition, 2012.*
2. *Machine Drawing- Luzzader, PHI Publishers,11th Edition.*
3. *Machine Drawing – Rajput, S. Chand Pub.*
4. *Textbook of Machine Drawing-K.C.John,2009, PHI learning, 1st Edition.*

NOTE:

- *The End exam will be for 4 hrs in the following format*
- *All answers should be on the drawing sheet only. Answers on the drawing sheet only will valued.*
- *First Angle Projections*
  - *Q1 Questions set on section I of the syllabus 2 out of 3 or 2 out of 4 to be answered with a weightage of 4 marks each-08 marks.*
  - *Q2 Questions set on section II of the syllabus 2 out of 3 to be answered with a weightage of 10 marks each-20 mrks.*
  - *Q3 Drawing of assembled views of section III items of syllabus with a weightage of 42 marks*

Suggestions:

Student should buy a book mentioned under Text books and study all the exercises given at the end of each chapter to equip him/her with the required ammunition.
Student should visit an automobile shop while the unit is being disassembled / assembled.
Student should go through the exercises given under assembly drawings refereeing to various books in the library to improve his assimilation capacity.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. II - I Sem. **L C**
3 2

(13A99303) MATERIAL SCIENCE LAB AND MECHANICS OF SOLIDS LAB

(A) MATERIAL SCIENCE LAB:

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

(B) MECHNICS OF SOLIDS LAB

1. Direct tension test beam
2. Bending test on
   a) Simply supported beam
   b) Cantilever beam
3. Torsion test
4. Hardness test
5. Brinells hardness test
6. Rockwell hardness test
7. Test on springs
8. Compression test on cube
9. Impact test
10. Punch shear test

NOTE:

- *Minimum of 4 from (A) and 6 from (B) experiments need to be performed*
- *Internal and End examinations evaluation will be done separately and the average will recorded.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. II - I Sem. **L** **C**
3 **2**

(13A99304) ELECTRICAL & ELECTRONICS ENGINEERING LAB

PART- A: ELECTRICAL LAB

1. Verification of Superposition Theorem.
2. Verification of Thevenin's Theorem.
3. Open Circuit Characteristics of D.C.Shunt Generator.
4. Swinburne's Test on DC Shunt Machine (Predetermination of Efficiency of a Given DC Shunt Machine Working as Motor and Generator).
5. Brake Test on DC Shunt Motor. Determination of Performance Characteristics.
6. OC & SC Tests on Single-Phase Transformer (Predetermination of Efficiency and Regulation at Given Power Factors).
7.

PART- B : ELECTRONICS LAB
(Any Six Experiments)

1. P-N Junction Diode and Zener Diode Volt-Ampere Characteristics.
2. Bipolar Junction Transistor in CB Configuration-Input and Output Characteristics, Computation of α.
3. Half-Wave Rectifier- a) Without Filter b) With Capacitor Filter.
4. Full-Wave Rectifier- a) Without Filter b) With Capacitor Filter.
5. Bipolar Junction Transistor in CE Configuration-Input and Output Characteristics, Computation of β.
6. Junction field effect Transistor in Common Source Configuration Output and Transfer Characteristics.
7. Verification of Logic Gates- AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. II – I Sem.

(13A52301) HUMAN VALUES & PROFESSIONAL ETHICS (AUDIT COURSE)

Course Objective:

This course deals with professional ethics which includes moral issues and virtues, social responsibilities of an engineer, right, qualities of Moral Leadership.

UNIT I

ENGINEERING ETHICS

Senses of 'Engineering Ethics' – Variety of Moral Issues – Types of Inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg's Theory – Gilligan's Theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT II

ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as Responsible Experimenters – Research Ethics – Codes of Ethics – Industrial Standards – A Balanced Outlook on Law – The Challenger Case Study

UNIT III

ENGINEER'S RESPONSIBILITY FOR SAFETY

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk – Chernobyl Case Studies and Bhopal

UNIT IV

RESPONSIBILITIES AND RIGHTS

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality– Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights –Intellectual Property Rights (IPR) – Discrimination

UNIT V

GLOBAL ISSUES

Multinational Corporations – Business Ethics – Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty –Moral Leadership – Sample Code of Conduct

Text Books:

1. *Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York 2005.*
2. *Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, 2000.*

Reference Books:

1. *Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.*
2. *John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003.*
3. *Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.*
4. *Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, 2004.*
5. *David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, 2003.*

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B.Tech. II - II Sem.	**Th**	**Tu**	**C**
	3	**1**	**3**

(13A01403) ENVIRONMENTAL SCIENCE

Course Objective:

- *To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.*

UNIT I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: – Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT II

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological sucession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

BIODIVERSITY AND ITS CONSERVATION: Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-soports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

SOLID WASTE MANAGEMENT: Causes**,** effects and control measures of urban and industrial wates – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT IV

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management –

Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Proggramme. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

FIELD WORK: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds – river, hill slopes, etc..

***Text Books**:*

1. *Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press, 2005.*
2. *Environmental Studies by Palanisamy, Pearson education, 2012.*
3. *Environmental Studies by R.Rajagopalan, Oxford University Press, 2nd edition, 2011.*

Reference Books:

1. *Textbook of Environmental Studies by Deeksha Dave and E.Sai Baba Reddy, Cengage Pubilications, 2nd edition, 2012.*
2. *Text book of Environmental Science and Technology by M.Anji Reddy, BS Publication, 2009.*
3. *Comprehensive Environmental studies by J.P.Sharma, Laxmi publications, 2nd edition, 2006.*
4. *Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited, 2nd edition, 1996.*
5. *Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited, 3rd edition, 2007.*

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B.Tech. II - II Sem.	**Th**	**Tu**	**C**
	3	**1**	**3**

(13A54303) PROBABILITY AND STATISTICS

Course Objective:

- *To help the students in getting a thorough understanding of the fundamentals of probability and usage of statistical techniques like testing of hypothesis, ANOVA, Statistical Quality Control and Queuing theory.*

Learning Outcome:

- *The student will be able to analyze the problems of engineering & industry using the techniques of testing of hypothesis, ANOVA, Statistical Quality Control and Queuing theory and draw appropriate inferences.*

UNIT I

Conditional probability – Baye's theorem. Random variables – Discrete and continuous Distributions – Distribution functions. Binomial and poison distributions Normal distribution – Related properties.

UNIT II

Test of Hypothesis: Population and Sample - Confidence interval of mean from Normal distribution - Statistical hypothesis - Null and Alternative hypothesis - Level of significance - Test of significance - Test based on normal distribution - Z test for means and proportions; Small samples - t- test for one sample and two sample problem and paired t-test, F-test and Chi-square test (testing of goodness of fit and independence).

UNIT III

Analysis of variance one way classification and two way classification (Latic square Design and RBD)

UNIT IV

Statistical Quality Control: Concept of quality of a manufactured product -Defects and Defectives - Causes of variations - Random and assignable - The principle of Shewhart Control Chart-Charts for attribute and variable quality characteristics- Constructions and operation of X- bar Chart, R-Chart, P-Chart and C-Chart.

UNIT V

Queuing Theory: Pure Birth and Death process, M/M/1 & M/M/S & their related simple problems.

Text Books:

1. *Probability & Statistics for engineers by Dr. J. Ravichandran WILEY-INDIA publishers.*
2. *Probability & Statistics by T.K.V. Iyengar, S.Chand publications.*

Reference Books:

1. *Probability & Statistics by E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.*
2. *Statistical methods by S.P. Gupta, S.Chand publications.*
3. *Probability & Statistics for Science and Engineering by G.Shanker Rao, Universities Press.*
4. *Probability and Statistics for Engineering and Sciences by Jay L.Devore, CENGAGE.*
5. *Probability and Statistics by R.A. Jhonson and Gupta C.B.*

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B.Tech. II - II Sem.	**Th**	**Tu**	**C**
	3	**1**	**3**

(13A03401) KINEMATICS OF MACHINERY

Course Objective:
The objective of this course is to cover the kinematics and dynamics of planar single degree of freedom mechanisms. After this course the student should have general mathematical and computational skills to enable the kinematics and dynamics analysis of machine elements including linkages, cams and gears and also becomes familiar with gear terminology and drawing of the cam profiles.

UNIT I

MECHANISMS AND MACHINES: Elements or Links – Classification – Rigid Link, flexible and fluid link. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Mechanisms and machines – classification of mechanisms and machines – kinematic chain – inversion of mechanisms – inversions of quadric cycle chain – single and double slider crank chain.Mobility of mechanisms. Straight Line Motion Mechanisms- Exact and approximate, copiers and generated types –Peaucellier, Hart and Scott Russel – Grasshopper, Watt, Tchebicheff and Robert Mechanisms. Pantograph.

Learning outcome & Suggested Student Activities:
After completion of this unit students are in a position to identify different mechanisms, inversions of different kinematic chains and also to find mobility of mechanisms. To get more clarity on mechanisms and machines, the following URLs will be highly useful to the students to understand various concepts of mechanisms and machines. http://www.cs.cmu.edu/~rapidproto/mechanisms/chpt2.html, http://www.mhprofessional.com/downloads/products/0071704426/0071704426-ch01.pdf

UNIT II

STEERING MECHANISMS: Conditions for correct steering – Davis Steering gear, Ackermanns steering gear. Hooke's Joint (Universal coupling) -Single and double Hooke's joint — applications – Simple problems.

Belt, Rope and Chain Drives : Introduction, Belt and rope drives, selection of belt drive- types of belt drives, materials used for belts and ropes, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains- length, angular speed ratio, classification of chains.

Learning outcome &Suggested Student Activities:
After completion of this chapter students are able to understand the mechanism of Hooke's joint, steering mechanisms and belt friction. And are also able to solve numerical problems on Hooke's joint, belt and rope drives. Students can go through the textbooks for the problems on Hooke's joint, belt and rope drives. The following URLs will be highly useful to the students to understand various concepts of steering mechanisms and belt friction.
http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/pdf/mod13les1.pdf
http://www.youtube.com/watch?v=YzGM8Uc2HB0

UNIT III

KINEMATICS

Velocity and Acceleration Diagrams- Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, Coriolis acceleration, determination of Coriolis component of acceleration. Kleins construction. Analysis of slider crank mechanism for displacement, velocity and acceleration of slider using analytical method

Instantaneous Centre Method: Instantaneous centre of rotation, centrode and axode – relative motion between two bodies – Three centres in-line theorem – Locating instantaneous centres for simple mechanisms and determination of angular velocity of points and links.

Learning outcome & Suggested Student Activities:

After completion of this unit student are able to draw velocity and acceleration diagrams of simple plane mechanisms by using relative velocity method and instantaneous center method.Students can go through the textbooks given for the problems on analysis of mechanisms. The following URLs will be highly useful to the students to understand various concepts of velocity and acceleration diagrams.
http://www.freestudy.co.uk/dynamics/velaccdiag.pdf,
http://ebooks.library.cornell.edu/k/kmoddl/pdf/013_005.pdf

UNIT IV

GEARS: Higher pairs, friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Forms of tooth- cycloidal and involute profiles. Velocity of sliding – phenomena of interference – Methods to avoid interference.Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact.Introduction to Helical, Bevel and worm gearing.

GEAR TRAINS: Introduction –Types of gears – Simple, compound, reverted and Epicyclic gear trains. Train value – Methods of finding train value or velocity ratio – Tabular column method for Epicyclic gear trains. Torque in epicyclic gear trains.Differential gear of an automobile.

Learning outcome & Suggested Student Activities:

After completion of this unit student are able to know gears terminology, types of gears, length of path of contact, contact ratio and interference in gears. Further students are also able to design the gears to avoid interference and to calculate train value for different gear trains.Students may go through text books given for more number of problems on gears and gear trains. Students may also refer the books authored by R.L. Norton and also by J.E.Shigley in addition to the textbooks for this unit to get more clarity on this unit. The following URLs will be highly useful to the students to understand various concepts of gears and gear trainshttp://www.nptel.iitm.ac.in/courses/IIT-MADRAS/Machine_Design_II/pdf/2_1.pdf, http://vedyadhara.ignou.ac.in/wiki/images/e/e8/BME-020_B-3(Unit_10).pdf
http://www.youtube.com/watch?v=qLVwXZ2sS48

UNIT V

CAMS:Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes. Drawing of cam profiles.

ANALYSIS OF MOTION OF FOLLOWERS: Tangent cam with roller follower – circular arc (Convex) cam with flat faced and roller follower.

Learning outcome &Suggested Student Activities:

After completion of this unit the students are able to draw displacement diagram and cam profile for different types of motions of the follower. And also to find the displacement, velocity and acceleration of the follower at different positions of cam with specified contours. The following URLs will be highly useful to the students to understand various concepts of drawing the cam profile for different followers.http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Kinematics%20of%20Machine/site/coursecontent/cntmod10.htm,http://www.youtube.com/watch?v=UpS8OjdXSow

Text Books:

1. *Theory of Machines, S.S. Rattan, Tata McGraw Hill Publishers, 3rd Edition,2013.*
2. *Kinematics and dynamics of machinery, R.L Norton ,Tata McGraw Hill Publishers,1st Edition, 2009.*

Reference Books:

1. *Theory of Machines and Mechanisms, 3rd Edition, J.E. Shiegley et. al, Oxford International Student Edition.*
2. *Theory of Machines, Thomas Bevan, Pearson (P) 3rd Edition, 2012.*

***NOTE** : Exam should be conducted in Drawing Hall*

Suggestions:
Students may visit nearby machine tool shops and automobile workshops to know about different mechanisms, gears, gear trains, flexible drives and cams. Students are suggested to search the web and identify different URLs which provide animations of mechanisms for better visualization and understanding purpose.

WEB References:
http://nptel.iitk.ac.in
http://ptumech.loremate.com/tom1/node/1
http://www.youtube.com/watch?v=6coD3oOuhr8

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B.Tech. II - II Sem.	Th	Tu	C
	3	1	3

(13A03402) THERMAL ENGINEERING – I

Course Objective:
The objective of this subject is to impart the knowledge of engine components, working principles of IC engines, auxiliary systems, the combustion aspects of SI and CI engines in addition to the methods of improving performance. The students shall become aware on the latest developments in the field of IC engines like MPFI , CRDI etc. and also shall become familiar about the working of Reciprocating and Rotary Compressors. The student also shall apply the thermodynamic concepts in IC engines and compressors.

UNIT I

I.C. ENGINES: Definition of Engine And Heat Engine, I.C Engine Classification – Parts of I.C.Engines, Working of I.C. Engines, Two Stroke & Four Stroke I.C.Engines SI & CI Engines, Valve and Port Timing Diagrams.

Learning Outcome & Suggested Student Activities:
*After completion of the unit, student can know working of both S.I and C.I engines with the help of indicator diagrams. Student can differentiate the working of 2-S and 4-S engines and also can draw valve and port timing diagrams. Student can know applications of IC engine in the automobile industry. Students are advised to visit nearby automobile service center/station and engines laboratory for Knowing the various engines and engine components. Student can also see various types of engines fitted to two wheelers, four wheelers, and diesel power plants. The following URLs will be highly useful to the students to understand various aspects of I.C.Engines*http://www.youtube.com/watch?v=XfJjvRTQP3M *, http://www.youtube.com/watch?v=MNrVYG_NdD4.*http://www.youtube.com/watch?v=W8oWq2Iv_W4,www.youtube.com/user/Techtrixinfo.

UNIT II

Fuel System: S.I. Engine: Fuel Supply Systems, carburetor types Air Filters, Mechanical and Electrical Fuel Pump – Filters– Gasoline Injection Systems..
Cooling & Lubrication Systems: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo Siphon, Water And Forced Circulation System; Lubrication Systems-Flash, Pressurized and Mist Lubrication.
Ignition System: Function Of An Ignition System, Battery coil Ignition System, Magneto Coil Ignition System, Electronic Ignition System using Contact Breaker, Electronic Ignition using Contact Triggers – Spark Advance And Retard Mechanism.

Learning Outcome & Suggested Student Activities:
Student can understand the fuel supply systems, cooling, lubrication and ignition systems. Student can understand how auxiliary systems play key role in increasing the performance of an I.C engine.
Student is advised to visit nearby automobile service center/station for getting practical knowledge about various auxiliary systems. Student can find the radiator (air cooling and water cooling) in front of heavy vehicles and stationary engines and air cooling for two wheelers and three wheelers.
The following URLs will be highly useful to the students to understand various aspects of fuel supply systems, filters, cooling, lubrication systems and Ignition systems.
http://www.youtube.com/watch?v=ksG4ypoMEaM;http://www.youtube.com/watch?v=LwrL-Cn9HT8;http://www.youtube.com/watch?v=O_Y3dM8ZApo;
http://www.youtube.com/watch?v=mmmcj53TNic

UNIT III

Fuels and Combustion:
S I engine :Normal Combustion and Abnormal Combustion – Importance of Flame Speed and Effect of Engine Variables – Type of Abnormal Combustion, Pre-Ignition and Knocking (Explanation) – Fuel Requirements and Fuel Rating, Anti Knock Additives, Combustion Chambers.

C.I. Engines: Stages Of Combustion – Delay Period And Its Importance – Effect Of Engine Variables – Diesel Knock– Combustion Chambers (DI And IDI), Fuel Requirements And Fuel Rating.

Learning Outcome & Suggested Student Activities:
Student can understand the flame propagation inside the cylinder, stages of combustion in S.I and C.I engines. Student can understand the knocking phenomenon. Student can know about Octane number and Cetane number of fuels and properties of fuel. Combustion Process is very typical process practically students can't see but student can understand the combustion process by visiting following URLs. Students are suggested to know various losses occurred through combustion chamber, at least theoretically.
http://www.youtube.com/watch?v=ep1NhANcCL4; http://www.youtube.com/watch?v=pqa4zCo4erY

UNIT IV

Testing and Performance : Parameters of Performance - Measurement of Cylinder Pressure, Fuel Consumption, Air Intake, Exhaust Gas Composition, Brake Power – Determination of Frictional Losses And Indicated Power – Performance Test – Heat Balance Sheet and Chart.

Learning Outcome & Suggested Student Activities:
Student can be familiar with indicated power, brake power and friction power and their methods of measurement. Student can understand the methods to increase the engine performance. Also, student can know calculating specific fuel consumption, A/F ratio and mean effective pressure and estimating heat losses etc. Students are advised to visit heat engines laboratory for analyzing the effect of various parameters on engine performance.
To better understand the above following URLs are useful.
http://web.iitd.ac.in/~ravimr/courses/mel345/ignou-notes.pdf;

UNIT V

Air Compressors: Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Single Stage and Multi Stage Compressors, Effect of Inter cooling and Pressure Drop in Multi - Stage Compressors, Problems Related to Reciprocating Compressors, Working principles of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow Compressors.

Learning Outcome & Suggested Student Activities:
Student can differentiate the working of reciprocating and rotary air compressors. Student can calculate work done by single and multistage reciprocating air compressors. Student can understand how intercooling reduces the work done / kg of air.
To gain further practical knowledge students are advised to visit laboratory/automobile workshop to see different types of compressors. The following URLs will be highly useful to the students to understand the air compressors.
http://www.ustudy.in/node/5106 ; http://www.youtube.com/watch?v=Ue7BkzBARXw
http://www.youtube.com/watch?v=6zYHUXSG3HE; http://www.youtube.com/watch?v=OuK6nGibFqY

Students are advised to refer the text book of "Internal Combustion Engine Fundamentals" by John B. Heywood.

Text Books:

1. *Internal Combustion Engines / V. Ganesan- TMH, 4th Edition,2012*
2. *Thermal Engineering / Rajput / Lakshmi Publications, 9th Edition,2013*

Reference Books:

1. *IC Engines – Mathur& Sharma – DhanpathRai& Sons, ,2010*
2. *Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI, 2nd Edition,2009*
3. *Thermal Engineering, Rudramoorthy – TMH, 10th Edition,2010*
4. *Thermodynamics & Heat Engines, B. Yadav, Central publishing house., Allahabad, 2002*
5. *I.C. Engines fundamentals, Heywood, McGrawHIll, 1st Edition,2011*
6. *Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand, 15th Edition,2012*

WEB Resources:
http://autoclub.rso.siuc.edu/frange.html
http://www.howstuffworks.com/engine1.htm
http://inventors.about.com/library/inventors/blinternalcombustion.htm http://www.animatedengines.com/

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B.Tech. II - II Sem.	**Th**	**Tu**	**C**
	3	**1**	**3**

(13A01408) MECHANICS OF FLUIDS

Course Objective:
In essence, this course introduces the fundamentals of fluid mechanics for engineers. The emphasis is on basis of fluid statics and fluid motion with application in a variety of engineering fields. This subject will introduce to study the various fluid properties and their significance in engineering problems and the basic concepts of fluid flow, both kinematics and dynamics, including the derivation of equation needed for the analysis of fluid flow problems. Students shall become familiar on different types of flow in pipes, theory of boundary layer, derivation of the equations associated with it and fundamentals of forces on submerged bodies like drag and lift and their significance.

UNIT I
FLUID STATICS: Dimensions and units, physical properties of fluids –mass density, specific weight, specific gravity, viscosity, surface tension, vapor pressure, compressibility, elasticity and their influence on fluid motion – atmospheric, gauge and vacuum pressure, measurement of pressure – piezometer, U-tube and differential manometers – hydro static forces on plane and curved surfaces.

Learning Outcome & Suggested Student Activities:
At the end of this unit the student shall learn the fundamental fluid properties and their engineering significance. The student is able to differentiate between different pressures and study the methods of fluid pressure measurement. Calculation of forces on different surfaces is also known to the student.
The students are advised to visit the following websites for video lectures on these topics
http://nptel.iitm.ac.in/courses
http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv078-Page1.htm

UNIT II
FLUID KINEMATICS: Introduction – velocity and acceleration - Stream line, path line and streak line - stream tube - classification of flows – equation of continuity for one dimensional flow and three dimensional flow – circulation and vorticity – velocity potential and stream function – flow net.
FLUID DYNAMICS: Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

Learning Outcome & Suggested Student Activities:
At the end of this unit the student shall have basic idea about the fundamentals of fluid flow and its description. The student is exposed to the fundamental equations, used in the analysis of fluid flow problems like continuity, energy and momentum equations.
The students are advised to visit the following websites for video lectures on these topics
http://nptel.iitm.ac.in/courses/105101082/
http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv078-Page1.htm

UNIT III
PIPE FLOW: Reynold's experiment – types of flow - Darcy Weisbach equation – Hagen Poiseuille equation Minor losses in pipes – pipes in series and pipes in parallel – total energy line hydraulic gradient line.
MEASUREMENT OF FLOW: Velocity measurement - Pitot tube, venturi meter, and orifice meter, Flow nozzle, Turbine flow meter – flow through orifices and mouth pieces – notches and weirs

Learning Outcome & Suggested Student Activitie:
At the end of this unit the student shall know the different types of pipe flow and the conditions governing them. Equations related to different flows are derived and the student gets to understand the working of the different devices used for measurement of fluid flow under different conditions.
The students shall browse the following websites for video lectures on these topics
http://nptel.iitm.ac.in/courses/105101082/
http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv078-Page1.htm

UNIT IV

Boundary Layer Theory: Boundary gap layer – definition – growth over a flat plate – boundary layer thickness – nominal, displacement, momentum and energy thickness – laminar sub layer –Momentum integral equation of boundary layer - separation of boundary layer- methods of controlling the boundary layer.

Learning Outcome & Suggested Student Activities:

At the end of this unit the student shall have understanding of the boundary layer and its significance along with the various concepts of boundary layer like its growth, thickness and separation. The student is able to appreciate the engineering significance of the boundary layer in this unit.

The students are advised to visit the following websites for video lectures on these topics

http://nptel.iitm.ac.in/courses/105101082/

http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv078-Page1.htm

UNIT V

FORCES ON SUBMERGED BODIES: Introduction – types of drag – drag on a sphere – drag on a cylinder – drag on flat plate – drag on airfoil – effect of compressibility on drag – development of lift on circular cylinder – Magnus effect – lift on an airfoil.

Learning Outcome & Suggested Student Activities:

At the end of this unit the student shall be able to learn about the importance of the forces exerted by the fluid on the body and vice versa. These concepts will be helpful to the student in understanding the effect of these forces on flatplate, sphere, cylinder and airfoil. The student is also exposed to engineering applications of the concepts of drag and lift

The students are advised to visit the following websites for video lectures on these topics

http://nptel.iitm.ac.in/courses/105101082/

http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv078-Page1.htm

Text Books:

1. *Hydraulics, fluid mechanics including hydraulic machines by Modi and Seth, Standard Publishers, 19th Edition,2013*
2. *Fluid Mechanics and Fluid Power Engineering by D. S. Kumar, Kotaria& Sons, 7th Edition,2011*

Reference Books:

1. *Fluid Mechanics and hydraulic Machines by R.K. Bansal, Laxmi Publications,9th Edition,2010*
2. *Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand,5th Edition,2013*
3. *Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International, 1st Edition*
4. *Hydraulic Machines by Banga& Sharma, Khanna Publishers, 7th Edition,2007*
5. *Instrumentation for Engineering Measurements by James W. Dally, William E. Riley, John Wiley & Sons Inc. 2004 (Chapter 12 – Fluid Flow Measurements), 2nd Edition.*

Suggestions:

1. *The students are advised to buy a text book, he/she may go in for Modi & Seth which covers the syllabus prescribed completely and effectively.*
2. *Students are supposed to have basic knowledge of calculus to grasp the various concepts of the subject.*
3. *Students are advised to solve as many numerical problems as possible to understand and apply the various concepts related to fluid flow. For this, student may refer to text books, by R.K. Bansal and R.K. Rajput.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. II - II Sem.	**Th**	**Tu**	**C**
	3	**1**	**3**

(13A03403) MANUFACTURING TECHNOLOGY

Course Objective:
By this subject the students will understand how manufacturers use technology to change raw materials into finished products. The students shall also introduce the basic concepts of casting, pattern preparation, gating system and knowledge on basic features of various welding and cutting processes. And also to study the concepts of surface treatment process, their characteristics and applications

UNIT I

CASTING: Definition, elements, Steps involved in making a casting– Types of patterns - Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction. Principles of Gating, Gating ratio and design of Gating systems, time of filling the cavity. Design of core prints, buoyancy principle. Moulds: definition, mould materials, types of moulds, moulding methods, moulding machines, tests. Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys.

Learning Outcome & Suggested Student Activities:
Students can understand the elements of casting, construction of patterns and gating systems, moulds, methods of moulding, moulding machines and solidification of castings of various metals. Students are advised to visit URLs http://www.nptel.iitm.ac.in/ and iitr.ac.in, www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm.

UNIT II

SPECIAL CASTING PROCESSES: Process Mechanics, characteristics, parameters and applications of Centrifugal, Die, and Investment casting.
RISERS – Types, function and design, casting design considerations, Design of feeding systems i.e., sprue, runner, gate and riser, moulding flasks
METHODS OF MELTING: Crucible melting and cupola operation, steel making processes.
Casting inspection and defects

Learning Outcome & Suggested Student Activities:
Students can understand the different types of special casting methods and their applications, design of risers and feeding systems, crucible melting, cupola operation and steel making process. The students may also be able to design a casting process on his own. The students are also advised to visit a Casting Industry nearby to get practical exposure.

UNIT III

A) **WELDING** : Classification of welding processes types of welds and welded joints and their characteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding.
B) **CUTTING OF METALS**: Oxy – Acetylene Gas cutting, water plasma. Cutting of ferrous, non-ferrous metals

Learning Outcome & Suggested Student Activities:
Students can understand the different types of welding processes, welds and weld joints, their characteristics, cutting of ferrous and non-ferrous metals by various methods. The students are advised to visit nearby welding shop for better understanding of welding process.

UNIT IV

Mechanics, characteristics, process parameters, applications of Inert Gas welding, TIG & MIG welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering & Brazing and adhesive bonding. Heat affected zones in welding; welding defects – causes and remedies – destructive and nondestructive testing of welds

.

Learning Outcome & Suggested Student Activities:
Students can understand about advanced welding process, heataffected zone(HAZ), Defects and Identification Methods. The students are advised to visit nearby welding shop and MFT Lab in the college.

UNIT V

SURFACE ENGINEERING: Surface treatment processes and their characteristics and applications. (a) Overlay coatings (b) Diffusion coatings (c) Thermal or mechanical modification of surfaces

Learning Outcome & Suggested Student Activities:
Students can understand the various surface treatment processes. Student is advised to visit the nearby surface coating industry.

Text Books:

1. *Manufacturing Technology, Vol I P.N. Rao, Tata Mc Graw Hill, 4th Edition,2013*
2. *Manufacturing Technology, Kalpakjain, Pearson education, 4th Edition,2002*

Reference Books:

1. *Production Technology, K.L Narayana, I.K. International Pub, 3rd Edition,2013*
2. *Manufacturing Process Vol. I, H.S.Shah Pearson, 2013,*
3. *Principles of Metal Castings, Rosenthal, Tata Mc Graw Hill ,2nd Edition,2001*
4. *Welding Process, Parmar.*
5. *Manufacturing Technology, R.K. Rajput, Laxmi Pub, 1st Edition,2007*
6. *Workshop Technology – B.S.RaghuVamshi – Vol I.*

WEB References:

NPTEL Lectures
http://teacher.buet.ac.bd/shabnam/14250_ch3.pdf http://me.emu.edu.tr/majid/MENG364/2_casting.pdf
http://en.wikipedia.org/wiki/Metalworking

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. II – II Sem. **L C**
3 2

(13A03404) THERMAL ENGINEERING LAB

1. Valve / Port Timing Diagrams of an I.C. Engines
2. Performance Test on a 4 -Stroke Diesel Engines
3. Performance Test on 2-Stroke Petrol engine
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Engine
5. Retardation and motoring test on 4- stroke engine
6. Heat Balance of an I.C. Engine.
7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.
8. Performance Test on Variable Compression Ratio Engines, economical speed test.
9. Performance Test on Reciprocating Air – Compressor Unit
10. Study of Boilers
11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. II - II Sem.	**L**	**C**
	3	**2**

(13A03405) MANUFACTURING TECHNOLOGY LAB

Minimum of 12 Exercises need to be performed

I. METAL CASTING LAB:

a. Pattern Design and making - for one casting drawing.
b. Sand properties testing - Exercise -for strengths, and permeability – 1
c. Moulding: Melting and Casting - 1 Exercise

II. WELDING LAB:

a. Arc Welding: Lap & Butt Joint - 2 Exercises
b. Spot Welding - 1 Exercise
c. TIG Welding - 1 Exercise
d. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

III. MECHANICAL PRESS WORKING:

a. Blanking & Piercing operation and study of simple, compound and progressive press tool.
b. Hydraulic Press: Deep drawing and extrusion operation.
c. Bending and other operations

IV. PROCESSING OF PLASTICS:

a. Injection Moulding
b. Blow Moulding

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B.Tech. III-I Sem.	**Th**	**Tu**	**C**
	3	**1**	**3**

(13A03501) HYDRAULIC MACHINERY

Course Objective:
The aim of this course is to make the students familiar with the different components of a hydroelectric power plant and understand the basic concepts of power production using energy of water along with estimation of potential of power generation. And also to make the students to study the working of hydraulic machines, their features of design and working proportions.

UNIT I
HYDROELECTRIC POWER STATIONS: Elements of hydro electric power station – types – concept of pumped storage plants – storage requirements, mass curve (explanation only) estimation of power developed from a given catchment area; heads and efficiencies.

Learning Outcome & Suggested Student Activities:
At the end of this unit the student shall have an overview of different aspects of hydro power generation. The student gets an idea about the different types of power plant and estimation of power that can be generated from these plants besides the study of different heads and efficiencies.
The students are advised to visit the following websites for video lectures on these topics
http://nptel.iitm.ac.in/courses/105101082/ ; http://ga.water.usgs.gov/edu/hyhowworks.html

UNIT II
BASICS OF TURBO MACHINERY: Hydrodynamic force of jets on stationary and moving flat, inclined, curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Learning Outcome & Suggested Student Activities:
At the end of this unit the student shall learn about the different cases of impact and the work done in all these cases. The student shall be able to draw the velocity triangles and analyse the same to arrive at the required quantities. Different cases of flow are made known to the student.
The students are advised to visit the following websites for video lectures on these topics
http://nptel.iitm.ac.in/courses/105101082/ ; http://ga.water.usgs.gov/edu/hyhowworks.html

UNIT III
HYDRAULIC TURBINES: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine – working proportions, work done, efficiencies, hydraulic design – draft tube theory – functions and efficiency.

Learning Outcome & Suggested Student Activities:
At the end of this unit the student shall be able to understand the features and working of different hydraulic turbines and their use. The student is also exposed to the aspects of hydraulic design of the turbines along with the calculation of various quantities like work done and efficiency. The students are advised to visit the following websites for video lectures on these topics
http://nptel.iitm.ac.in/courses/105101082/;http://www.youtube.com/watch?v=wvxUZF4lvGw&feature=player_detailpage

UNIT IV
PERFORMANCE OF HYDRAULIC TURBINES: Geometric similarity - unit quantities – performance under specific conditions – specific speed - characteristic curves - Governing of turbines - Selection of type of turbine – model testing of turbines – cavitation - surge tank - water hammer.

Learning Outcome & Suggested Student Activities:
At the end of this unit the student shall know about the evaluation of the performance of the various hydraulic turbines. The student shall also have idea about the calculation of different quantities used for predicting the behavior and performance of turbines besides knowing the importance of different effects of cavitation and water hammer. The students are advised to visit the following websites for video lectures on these topics

http://nptel.iitm.ac.in/courses/105101082/
http://www.mech.uq.edu.au/courses/mech7350/lecture-notes-in-pdf/mech7350-10-hydraulic-turbines.pdf

UNIT V

PUMPS-Centrifugal pumps: Classification, working, work done – manometric head – losses and efficiencies specific speed – pumps in series and parallel - performance – characteristic curves, NPSH. Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

Learning Outcome & Suggested Student Activities:

At the end of this unit the student shall have an opportunity to understand the various types and purposes of hydraulic machines (pumps). The student is exposed to different types of pumps, their working and applications. This makes the student capable of selecting the suitable pump according to the requirement.

The students are advised to visit the following websites for video lectures on these topics
http://nptel.iitm.ac.in/courses/105101082/;http://www.youtube.com/watch?v=FENCiA-EfaA&feature=player_detailpage

Text Books:

1. *Hydraulics, fluid mechanics and hydraulic machinery by Modi and Seth, Standard Publishers, 19th Edition,2013.*
2. *Fluid Mechanics and Hydraulic Machines by R.K Rajput. 5th Edition,2013.*

Reference Books:

1. *Fluid Mechanics and Hydraulic Machinery by R.K. Bansal, Laxmi Publicaitons (P) Ltd. 9th Edition,2012.*
2. *Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International. 1st Edition,*
3. *Hydraulic Machines by Banga& Sharma, Khanna Publishers.*

JagadishLal, Hydraulic Machines, Metropolitan Book Company Pvt. Ltd.

Suggestions:

1. *Students are advised to buy a text book, he/she may go in for Modi& Seth which covers the syllabus prescribed completely and effectively.*
2. *Students are supposed to have prerequisite knowledge of various equations of fluid flow*
3. *Students are advised to practice the solution of the different cases of problems involving velocity triangles. For this, student may refer to text books, by R.K. Bansal and R.K. Rajput.*
4. *Students are advised to visit hydal power plant*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. III-I Sem.	**Th**	**Tu**	**C**
	3	**1**	**3**

(13A03502) THERMAL ENGINEERING – II

Course Objective:
This subject is designed to provide a sound knowledge in various aspects of thermal equipments. This subject has an increasingly dominant role to play in the vital areas of power generation, Automobiles, R&AC and energy sector. The course contents aims at developing the necessary analytical and technical contents among engineers in these areas. The students shall become familiar with steam power plant, boilers, function of nozzle, gas turbines and jet propulsions.

UNIT I

BASIC CONCEPTS: Rankine Cycle - Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Methods to Improve Cycle Performance – Regeneration – Reheating- Combined- Cycles.

Learning Outcome & Suggested Student Activities:
Student can be able to illustrate the power generation through Rankine cycle. Student can able understand efficiency enhancement methods of Reheating and regeneration. Student can able to understand the key role of quality of steam after evaporation.
Students are advised to be acquainted with the terms related to steam, steam tables and mollierchart.Also, students are advised to visit the thermal power station to get real expose.

UNIT II

BOILERS: Classification Based on Working Principles & Pressures of Operation - L.P & H.P. Boilers – Mountings and Accessories.
DRAUGHT: Classification – Height Of Chimney for Given Draught and Discharge, Condition for Maximum Discharge, Efficiency of Chimney – Artificial Draught, Induced and Forced Draught.

Learning Outcome & Suggested Student Activities:
Student can able to understand the working of different high pressure and low pressure boilers. Student can distinguish mountings and accessories. The student can calculate the chimney height for maximum discharge. Student can know the draughts and its application in the steam generator. Students are advised to visit the Boilers in the power generation units to get better expose. And visit the following URLs will be highly useful to the students to understand various aspects of thermal power plants and boilers.
https://www.youtube.com/watch?v=Ota2_LUuar0, https://www.youtube.com/watch?v=8GSUgwombdE

UNIT III

STEAM NOZZLES: Function of Nozzle – Applications - Types, Flow through Nozzles, Thermodynamic Analysis – Assumptions -Velocity of Nozzle at Exit-Ideal And Actual Expansion in Nozzle, Velocity Coefficient, Condition for Maximum Discharge, Critical Pressure Ratio.
Criteria for Design of Nozzle Shape: Super Saturated Flow and its Effects, Degree of Super Saturation and Degree of Under Cooling - Wilson Line –Shock at The Exit.
CONDENSERS: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

Learning Outcome & Suggested Student Activities:
Student can be able to distinguish the ideal flow and actual flow through nozzle. Student can know the importance of maximum discharge through nozzle. Student can able to entail the concept of Critical pressure ratio in calculations. Student can able to understand the effect of meta stable flow/ super saturation flow through nozzle.
Students are advised to visit the thermal power stations to acquire the practical expose and visit URL http://www.youtube.com/watch?v=cdUNmzcu2rA

UNIT IV

IMPULSE TURBINE: Mechanical Details – Velocity Diagram – Effect of Friction – Power Developed, Axial Thrust Blade or Diagram Efficiency – Condition for Maximum Efficiency. De-Laval Turbine - Its Features. Methods To Reduce Rotor Speed - Velocity Compounding And Pressure Compounding, Velocity And Pressure Variation Along The Flow – Combined Velocity Diagram For A Velocity Compounded Impulse Turbine.

REACTION TURBINE: Mechanical Details – Principle of Operation, Thermodynamic Analysis of A Stage, Degree of Reaction –Velocity Diagram – Parson's Reaction Turbine – Condition for Maximum Efficiency.

Learning Outcome & Suggested Student Activities:

At the end of unit, student can able to distinguish the working of impulse and reaction turbines. Student can able to construct the velocity triangle and combined velocity triangle and can learn its importance in determining the power produced by the turbine. Student can know why to reduce the rotor speed and methods to reduce.

Students are advised to visit thermal power stations for better understanding the working of turbines. Students are suggested to participate in science exhibitions based on the concept of thermal power plants. Student is advised to visit following URLs http://www.youtube.com/watch?v=y2dOmpZqYW8&list=PLBD7B1EEF7CCB7D9D , https://www.youtube.com/watch?v=1bl1Q3V_79I

UNIT V

GAS TURBINES:Simple Gas Turbine Plant – Ideal Cycle, Essential Components – Parameters of Performance – Actual Cycle – Regeneration, Inter Cooling and Reheating – Closed And Semi-Closed Cycles – Merits and Demerits, Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants

JET PROPULSION: Principle of Operation – Classification of Jet Propulsive Engines – Working Principles with Schematic Diagrams and Representation on T-S Diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo Jet, Turbo Prop, Pulse Jet Engines – Schematic Diagram, Thermodynamic Cycle. Introduction to Rocket Propulsion.

Learning Outcome & Suggested Student Activities:

After the study of the unit, Student can be familiar with the basic components of a gas turbine power plant. Student can illustrate the power generation using Joule Cycle. Student can know the methods to increase the specific power output and efficiency of the cycle. Also, Student can able to know the working of various propulsive devices. Student can aware of using thrust equations in solving problems. Students advised to visit Gas power generation plants.

http://www.youtube.com/watch?v=hnVWpOV5chs,http://www.youtube.com/watch?v=p1TqwAKwMuM , http://www.youtube.com/watch?v=MUxP3PCDRTE

Text Books:

1. *Thermal Engineering, R.K. Rajput, 9/e, Lakshmi Publications, 2013*
2. *Basic and Applied Thermodynamics, P.K. Nag, TMH , 2nd Edition,2012.*

Reference Books:

1. *Gas Turbines, V. Ganesan, TMH*
2. *Thermodynamics and Heat Engines, R.Yadav, Central Publishing House, Allahabad, 2002.*
3. *Gas Turbines and Propulsive Systems, P.Khajuria&S.P.Dubey, Dhanpatrai*
4. *Thermal Engineering, R.S Khurmi & JS Gupta, S.Chand, 2012.*
5. *Thermal Engineering-M.L.Mathur & F.S.Mehta, Jain bros, 2006.*
6. *Thermal Engineering Data Book, B.S. Reddy and K.H. Reddy, I.K. International, 2007.*
7. *Steam Tables SI Units- Dr.B.Umamaheswar Gowd and A. Nagraju, Siri Publ.*

NOTE: *Steam tables and Mollier charts to be supplied for exam.*

Web References:

http://www.iscid.org/encyclopedia/Tthermodynamics. http://www.transtutors.com/

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B.Tech. III-I Sem.	**Th**	**Tu**	**C**
	3	**1**	**3**

(13A03503) DYNAMICS OF MACHINERY

Course objective:
To understand the method of static force analysis and dynamic force analysis of mechanism, undesirable effects of unbalance in rotors and engines. To understand the concept of vibratory systems and their analysis and also the principles of governors.

UNIT I

FRICTION: Inclined plane, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear. Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

CLUTCHES: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

BRAKES AND DYNAMOMETERS: Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the basic concepts of friction in pivots and collars with uniform pressure and uniform wear, and also to solve the numerical problems on brakes, clutches and dynamometers.
Students may go through text books given for more number of problems on friction, brakes and clutches. The following URLs will be highly useful to the students to understand various concepts of friction and its application.
http://nptel.iitm.ac.in/video.php?subjectId=112104121, http://www.youtube.com/watch?v=FA04XFpJgwE

UNIT II

PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aeroplanes and ships.

TURNING MOMENT DIAGRAMS AND FLY WHEELS: Turning moment diagrams for steam engine, IC Engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed – Fly wheels and their design, Fly wheels for Punching machines.

Learning outcome & Suggested Student Activities:
After completion of this unit students can apply gyroscopic principles on Aeroplane, ship, four wheel and two wheel vehicles. Students are able to design a flywheel for IC engine. Students may go through text books given for more number of problems on gyroscopic effects and flywheels. The following URLs will be highly useful to the students to understand various concepts of gyroscopic couple and turning moment diagrams.
http://www.youtube.com/watch?v=FydJu1A1oeM&list=PL46AAEDA6ABAFCA78&index=7
http://www.youtube.com/watch?v=swgvKwyOnYk&list=PL46AAEDA6ABAFCA78&index=16

UNIT III

GOVERNORS: Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting. Effort and power of a governor.

Learning outcome & Suggested Student Activities:
The outcome of this unit is to study the basics and definitions related to governors and forces acting on various governors. After completion of this unit students are able to solve numerical problems on different governors.
Students may go through text books given for more number of problems on governors. The following URLs will be highly useful to the students to understand various concepts on governors.
http://nptel.iitm.ac.in/video.php?subjectId=112104121, http://www.youtube.com/watch?v=OG1AiaNTT6s

UNIT IV

BALANCING: Balancing of rotating masses - single and multiple – single and different planes.

BALANCING OF RECIPROCATING MASSES: Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – V-engine, multi cylinder in-line and radial engines for primary and secondary balancing.

Learning outcome & Suggested Student Activities:

After completion of this unit students can solve numerical problems on balancing of rotating masses and reciprocating masses in V-engine and multi cylinder engines.

Students may go through text books given for more number of problems on balancing of rotating masses and balancing of reciprocating masses in locomotives and IC engines. The following URLs will be highly useful to the students to understand various concepts of balancing of masses.

http://www.youtube.com/watch?v=aRulDXMuNDc&list=PL46AAEDA6ABAFCA78&index=8

http://nptel.iitm.ac.in/video.php?subjectId=112104121

UNIT V

VIBRATION: Free and forced vibration of single degree of freedom system, Role of damping, whirling of shafts and critical speeds. Simple problems on free, forced and damped vibrations. Vibration Isolation & Transmissibility. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly's method, Raleigh's method. Torsional vibrations - two and three rotor systems.

Learning outcome & Suggested Student Activities:

Upon completion of this unit, the student will perform detailed analysis of the response of one degree of freedom systems with free and forced vibrations, evaluate the critical speed of the shaft and simple vibration calculations of rotor systems. Students may go through text books given for more number of problems on single degree of freedom system, transverse and torsional vibrations. The following URLs will be highly useful to the students to understand various concepts on vibrations.

http://nptel.iitm.ac.in/video.php?subjectId=112104121

http://www.youtube.com/watch?v=irudCaBrij0&list=PL46AAEDA6ABAFCA78&index=30

Text Books:

1. *Theory of Machines, S.S. Rattan, MGH Publishers,3rd Edition,2013.*
2. *Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill.*

Reference Books:

1. *Theory of Machines, Thomas Bevan, Pearson, 3rd Edition,2012.*
2. *The theory of Machines, J.E. Shiegley, McGraw Hill .*
3. *Theory of Machines and Mechanisms of Shigley et.al. Oxford International Student Edition.*

NOTE: *End Exam Should be conducted in Drawing Hall*

Suggestions:

Students may visit near by machine tool shops and automobile work shops to know about clutches, bearings, brakes, dynamometers, flywheel, centrifugal governors and balancing equipment like wheel balancing. Students are suggested to search the web and identify different URLs which provide animations of mechanisms for better visualization and understanding purpose.

Web References:

Machine Dynamics by Prof. Amitabha Ghosh, IITK, Kanpur - http://nptel.iitm.ac.in/video.php?subjectId=112104114

Machine Dynamics by Prof. C. Amarnath, Prof. K. KurienIssac, Prof. P. Seshu of IITB, Mumbai

http://www.cdeep.iitb.ac.in/nptel/Mechanical/Dynamics%20of%20Machines/TOC.html

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. III-I Sem.	**Th**	**Tu**	**C**
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(13A03504) METAL FORMING PROCESSES

Course Objective:
Metal forming processes are highly non linear because they involve geometric, material and contact non linearity. And so this subject introduce the concepts of one, two and three dimensional stress analysis, theory of plasticity, strain hardening, hot and cold working process. The students also will get the awareness on various types of rolling mills, forgings, extrusions, wire drawing processes, sheet metal operations, concepts on plastic manufacturing processes and rapid manufacturing process and its applications.

UNIT 1
Stress, strain, Two dimensional stress analysis and three dimensional stress analysis, relation between engineering stress and true stress, relation between engineering strain and true strain, yield criteria, yield locus, theory of plasticity, Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts

Learning Outcome & Suggested Student Activities:
Students can understand the basic concept on one, two and three dimensional stress analysis, theory of plasticity, strain hardening, hot and cold working process. The students are advised to visit the URLs http://www.nptel.iitm.ac.in/iitkgp.ac.in, http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm.

UNIT II
ROLLING: Bulk deformation processes – Economics of bulk forming, principles and theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements, applications and, limitations, defects in rolled products – machinery and Equipment.
FORGING PROCESSES: Principles of forging –Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects, Forces in forging of strip, disc and power requirements, applications, Equipment and their selection.

Learning Outcome & Suggested Student Activities:
Students can understand the principles of rolling and forging processes, their applications and defects. The students are advised to visit URLs http://www.nptel.iitm.ac.in/iitkgp.ac.in, http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm

UNIT III
EXTRUSION PROCESSES: Basic extrusion process and its characteristics. Mechanics of hot and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion, forces in extrusion of cylindrical and non cylindrical components – characteristics and defects in extruded parts.
Wire Drawing: Process Mechanics and its characteristics, determination of degree of drawing, drawing force, power, and number of stages-defects in products.

Learning Outcome & Suggested Student Activities:
Students can understand the fundamentals of extrusion process and wire drawing processes and their industrial applications. The students are advised to visit the URLs http://www.nptel.iitm.ac.in/iitkgp.ac.in, http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm.

UNIT IV
Sheet Metal Working – Economical Considerations - Stamping, forming and other cold working processes: Blanking and piercing – Bending and forming – Drawing and its types – Cup drawing and Tube drawing – coining – Hot and cold spinning. Force and power requirement in sheet metal operations, defects in sheet metal products – Equipment, tooling and their characteristics.

Learning Outcome &Suggested Student Activities:
Students can understand the various press working processes, their advantages and disadvantages. The students are advised to refer the text book Workshop Technology by H***ajra Choudhary. Students are advised to visit nearby sheet metal works industries.***

UNIT V

Processing of plastics, injection and blow moulding, calendaring, thermo forming, compression moulding, transfer moulding, High energy rate forming methods Rapid manufacturing: - Introduction – concepts of rapid manufacturing, information flow for rapid prototyping, classification of rapid prototyping process, sterer holography fused deposition modeling, selective laser sintering, Applications of rapid prototyping process

Learning Outcome &Suggested Student Activities:
Students can understand the concept of plastic manufacturing process, rapid manufacturing process and its applications. Students are advised to visit the following URLs http://www.nptel.iitm.ac.in/iitkgp.ac.in, http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm.

Text Books:

1. *Manufacturing Technology, Schmid and kalpakjin, Pearson Education.*
2. *Manufacturing Technology, Foundry forming and welding, Vol I , P.N. Rao,TMH*

Reference Books:

1. *Production Technology, R.K. Jain, Khanna Publishers,17th edition, 2012*
2. *Process and materials of manufacturing –Lindberg, PE*
3. *Principles of Metal Castings, Rosenthal.*
4. *Welding Process, Parmar*
5. *Manufacturing Technology, R.K. Rajput, Laxmi Pub*
6. *Rapid Prototyping Principles and Applications, RafiqNoorani, Wiely Pub.*

Web Resources:

www.casde.iitb.ac.in/store/events/2003/IAT-Pune.../DFMA.ppt
www.rose-hulman.edu/~stienstr/ME470/DFA.ppt
www.design4manufacturability.com/DFM_article.htm

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(13A03505) DESIGN OF MACHINE MEMBERS – I

Course Objective:
The primary objective of this course is to demonstrate how engineering design is used for many principles learned in previous engineering science courses and to show how these principles are practically applied. This subject will help to the students to learn to analyze and design basic machine elements in mechanical systems. By this subject students will become familiar on design principles, materials selection, stresses developed in machine elements under different loads. The students will also get knowledge on design of the permanent and temporary joints, shafts and keys.

UNIT I

INTRODUCTION: General considerations of design, design process. Selection of Engineering Materials - properties –Manufacturing considerations in the design. BIS codes of materials, preferred numbers and interchangeability.

STRESSES IN MACHINE MEMBERS: Simple stresses – Combined stresses – Torsional and bending Stresses – impact stresses – stress -strain relation – Various theories of failure – factor of safety.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are capable to apply design procedures using theories of failure for different elements. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of machine design. http://machinedesign.com/
http://www.youtube.com/watch?v=qVj4VvMmQjc&list=PL3D4EECEFAA99D9BE&index=6

UNIT II

DESIGN FOR FLUCTUATING LOADS: Stress concentration –notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Goodman's line – Soderberg's line. Design of components for finite and infinite life.

Learning Outcome & Suggested Student Activities:
After completion of this chapter students are able to design simple components under cyclic loading using Goodman's and Soderberg's criterions. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of cyclic loading design. http://machinedesign.com/
http://www.youtube.com/watch?v=SLqkITQfN1I&list=PL3D4EECEFAA99D9BE&index=8

UNIT III

DESIGN OF RIVETED JOINTS: Types of riveted joints, design of riveted joints. Boiler shell riveting design and eccentric loading design of riveted joints.

DESIGN OF BOLTED JOINTS: Forms of Screw threads. Stresses in Screw fasteners. Design of bolts with pre-stresses, Design of bolted joints under eccentric loading, Bolts of uniform strength.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to design riveted joints with different configuration, boiler shell joint design and eccentric loading design of riveted joints. Further students are able to design bolted joints with direct loading and eccentric loading. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of joints. http://machinedesign.com/
http://www.youtube.com/watch?v=Z38Aq9ykUCM&list=PL3D4EECEFAA99D9BE&index=16

UNIT IV

DESIGN OF COTTERS AND KNUCKLE JOINTS: Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints

DESIGN OF SHAFTS: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Standard shaft sizes.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to design cotter joint, knuckle joint and shafts. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of shafts, http://machinedesign.com/
http://www.youtube.com/watch?v=4nlQwVqruRo&list=PL3D4EECEFAA99D9BE&index=20

UNIT V

DESIGN OF KEYS AND COUPLINGS: Design of Rigid couplings: Muff, Split muff and Flange couplings- Design of flexible couplings.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to design various rigid and flexible shaft couplings. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of couplings. http://machinedesign.com/
http://www.youtube.com/watch?v=4nlQwVqruRo&list=PL3D4EECEFAA99D9BE&index=21

Text Books:

1. *Design of Machine Elements, V.B.Bhandari , TMH Publishers, NewDelhi, 2nd edition, 2013*
2. *MachineDesign,Schaum'sseries,TMHPublishers, NewDelhi, 1st edition, 2011*
3. *MachineDesign,R.K.Jain,KhannaPublishers,NewDelhi.*

Reference Books:

1. *MachineDesign,SadhuSingh,KhannaPublishers, NewDelhi*
2. *MachineDesign,R.S. Kurmi and J.K. Gupta ,S.ChandPublishers, NewDelhi*
3. *MechanicalEngineeringDesign,JosephE.Shigely,TMH Publishers,NewDelhi, 9th edition, 2011 R*
4. *DesignofMachineElements,M.F.Spotts, PHIPublishers, NewDelhi.*
5. *MachineDesign,PandyaandShah,CharotarPublishers,Anand, 17th edition, 2009*
6. *Machine Design, R.L. Norton, Tata McGrawHillPublishers, 2nd edition, 2002*
7. *Machine Design by Groover – CBS Publications, 5th edition, 2012.*

NOTE: *Design data books are not permitted in the examinations.*

Web Resources:

http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv077-page1.htm
http: // www .f a s t e n a l .c o m / c o n t e n t / f e d s / p d f / A r t i c l e % 2 0 - %20Bolted%20Joint%20Design.pdf
http://people.rit.edu/megite Lec%203%20Fatigue%20Failure% 20031004_ for_students.ppt
http://engineershandbook.com/Tables/materials.htm
www.nptel.iitm.ac.in/video

Suggestions:

1. Students may visit nearby automobile workshops and machine tool shops to know about different machine elements like shafts, keys, couplings and riveted and bolted joints.
2. In addition to the text books students may also go through the reference books authored by V.B. Bhandari, by Pandya and Shah for more number of numerical problems.

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(13A03506) HEAT TRANSFER

Course Objective:
The students will gain the ability to get an in-depth understanding of the principles governing the transfer of heat, the techniques , tools and skills required to solve typical thermal related problems, the analysis of energy flows in complicated systems and the design of efficient heat transfer equipments. Enables the student to utilize analogies to solve heat transfer problems. Further students gain hands-on experience in heat transfer experimentation through a number of laboratory tests.

UNIT I

Introduction: Modes and Mechanisms of Heat Transfer – Basic Laws of Heat Transfer – General Applications of Heat Transfer.

Conduction Heat Transfer: Fourier Rate Equation – General Heat Conduction Equation In Cartesian, Cylindrical and Spherical Coordinates.

Simplification and Forms of the Field Equation – Steady, Unsteady and Periodic Heat Transfer – Boundary and Initial Conditions.

One Dimensional Steady State Heat Conduction: In Homogeneous Slabs, Hollow Cylinders and Spheres – Overall Heat Transfer Coefficient – Electrical Analogy – Critical Radius/Thickness of Insulation – With Variable Thermal Conductivity – With Internal Heat Sources or Heat Generation

Learning Outcome & Suggested Student Activities:
After the completion of the unit, student can able to grasp the concept of steady state conduction. Student can learn representing conduction equation in various forms. Student can imply concept successfully to problems encounter in day to day life. The following URL's will be highly useful to students.
http://k12videos.mit.edu/content/heat-transfer; http://www.youtube.com/watch?v=9WwSaIP5pbs
http://www.youtube.com/watch?v=HIYCR7gXXFo; http://www.youtube.com/watch?v=S57nIs503fA
http://energy.concord.org/ir/experiments-page3.html

UNIT II

Heat Transfer in Extended Surface (Fins) – efficiency, effectiveness and temperature distribution on Long Fin, Fin with Insulated Tip and Short Fin, Application to Errors in Temperature Measurement.

One Dimensional Transient Heat Conduction: In Systems with Negligible Internal Resistance – Significance of Biot and Fourier Numbers – Chart Solutions of Transient Conduction Systems – Problems on Semi-infinite Body.

Learning Outcome & Suggested Student Activities:
After the completion of the chapter, student is expected understand the concept of extended surfaces and its applications. Also, student can aware transient heat conduction and how it vary w.r.t time. Student is expected to develop the ability to formulate practical conduction heat transfer problems by transforming the physical system into a Mathematical model and selecting an appropriate solution technique and evaluating the significance of results.
The following URLs will be highly useful to the students
http://www.youtube.com/watch?v=cMmREKOhIV8
http://www.youtube.com/watch?v=HiX7DKUlAOM

UNIT III

Convective Heat Transfer: Dimensional Analysis – Buckingham Π Theorem and Its Application for Developing Semi – Empirical Non-Dimensional Correlations for Convective Heat Transfer – Significance of Non-Dimensional Numbers – Concepts of Continuity, Momentum And Energy Equations.

Forced Convection: External Flows: Concepts of Hydrodynamic and Thermal Boundary Layer and Use of Empirical Correlations for Convective Heat Transfer for Flow Over – Flat Plates, Cylinders and Spheres.

Internal Flows: Division of Internal Flow through Concepts of Hydrodynamic and Thermal Entry Lengths – Use of Empirical Relations for Convective Heat Transfer in Horizontal Pipe Flow, Annular Flow.

Free Convection: Development of Hydrodynamic and Thermal Boundary Layer along a Vertical Plate – Use of Empirical Relations for Convective Heat Transfer on Plates and Cylinders in Horizontal and Vertical Orientation.

Learning outcome & Suggested Student Activities:

At the end of the chapter, Student will have the ability to formulate practical forced and natural convection heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique and evaluating the significance of results. Students will also demonstrate an ability to analyze the performance.

The following URLs will be highly useful to the students http://www.youtube.com/watch?v=HIYCR7gXXFo

http://www.youtube.com/watch?v=S57nIs503fA; http://energy.concord.org/ir/experiments-page3.html

UNIT IV

Heat Transfer with Phase Change:

Boiling: Pool Boiling – Regimes, Determination of Heat Transfer Coefficient in Nucleate Boiling, Critical Heat Flux and Film Boiling.

Condensation: Filmwise and Dropwise Condensation – Nusselt's Theory of Condensation on a Vertical Plate – Film Condensation on Vertical snd Horizontal Cylinders Using Empirical Correlations.

Heat Exchangers: Classification of Heat Exchangers – Overall Heat Transfer Coefficient and Fouling Factor – Concepts of LMTD and NTU Methods – Problems using LMTD And NTU Methods.

Learning outcome & Suggested Student Activities:

After the completion of the chapter, student will be able to calculate heat transfer in condensation and boiling systems, turbulent and laminar film condensation. Student can understand the concepts of critical heat flux and different models of critical heat flux. Student can able to grasp the fundamentals of heat exchangers and its analysis.

The following URLs will be highly useful to the students to understand simple heat exchangers.

MIT: Professor Z. S. Spakovszky's Lecture Notes on Thermodynamics & Propulsion: "Section 18.5: Heat Exchangers" (HTML)

Lecture: YouTube: Stanford University: Professor Channing Robertson's Introduction to Chemical Engineering: "Lecture 12: Heat Exchangers"

http://www.youtube.com/watch?v=Gu1ApKpcxQc

UNIT V

Radiative Heat Transfer: Emission Characteristics and Laws of Black-Body Radiation – Irradiation – Total and Monochromatic Quantities– Laws of Planck, Wien, Kirchoff, Lambert, Stefan And Boltzmann – Heat Exchange Between Two Black Bodies – Concepts of Shape Factor – Emissivity – Heat Exchange Between Gray Bodies – Radiation Shields – Electrical Analogy for Radiation Networks.

Learning outcome & Suggested Student Activitie:

At the end of the unit, student can have knowledge on fundamental laws of radiative heat transfer. Also, student can understand the concept of radiative heat transfer between black bodies and grey bodies. Student can know radiation shields and their applications. Student can determine shape factor for different geometries and can know its importance in determining radiative heat transfer.

The following URLs will be highly useful to the students -http://energy.concord.org/ir/experiments-page5.html

Text Books:

1. *Fundamentals of Engg. Heat and Mass Transfer, R.C. Sachdeva, 4/e, New Age International, 2010.*

Reference Books:

1. *Heat Transfer, P.K.Nag, 3/e, TMH, 2011*
2. *Heat Transfer, Ghoshdastidar, Oxford Univ. Press, 1st edition, 2004*

3. *Heat Transfer, Holman.J.P, 10/e, TMH, 2012*
4. *Heat and Mass Transfer, R.K.Rajput, S.Chand& Company Ltd, 2001*
5. *Fundamentals of Heat and Mass Transfer, Kondandaraman, C.P., 3/e, New Age Publ.*
6. *Fundamentals of Heat and Mass Transfer, Incropera, 5/e, Wiley India.*
7. *Thermal Engineering Data Book, B.S.Reddy and K.H.Reddy Rev/e, I.K. International, 2007*

NOTE: *Heat transfer Data books are permitted for Exam.*

Suggestion:

1. *Student is advised to visit heat transfer laboratory to understand the concept of three modes of heat transfer.*

Web References:

IIT video lecturers (NPTEL)
http://www.wisc-online.com/Objects/ViewObject.aspx?ID=SCE304
http://web.cecs.pdx.edu/~gerry/heatAnimations/sphereTransient/#TOC
http://rpaulsingh.com/animated%20figures/animationlisttopic.htm

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B.Tech. III-I Sem. **L** **C**
3 **2**

(13A03507) HEAT TRANSFER LAB

***NOTE**: Thermal Engineering data books are permitted in the examinations*

1. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus
3. Overall heat transfer co-efficient through Composite Slab Apparatus
4. Thermal Conductivity of metal (conductor).
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer coefficient in forced convection.
8. Heat transfer coefficient in natural convection
9. Experiment on Parallel and counter flow heat exchanger.
10. Emissivity of a gray body through Emissivity apparatus.
11. Experiment on Stefan Boltzman Apparatus.
12. Heat transfer in drop and film wise condensation.
13. Experiment on Critical Heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of Two – Phase flow.

***Note:** Any 10 of the above 15 experiments are to be conducted.*

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B.Tech. III-I Sem. **L** **C**
3 **2**

(13A01509) FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Discharge measurement through Venturimeter.
9. Discharge measurement through Orifice meter.
10. Estimation of friction factor for a given pipe line.
11. Estimation of loss of head due to sudden contraction in a pipeline.
12. Turbine flow meter.

***Note**: Any 10 of the above 12 experiments are to be conducted.*

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B.Tech. III-II Sem.	**Th**	**Tu**	**C**
	3	**1**	**3**

(13A52501) MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS (MEFA)

Course Objective:
The objectives of this course are to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to enrich analytical skills in helping them take sound financial decisions for achieving higher productivity.

Learning Outcome:
The thorough understanding of Managerial Economics and Analysis of Financial Statements facilitates the Technocrats – cum – Entrepreneurs to take-up decisions effectively and efficiently in the challenging Business Environment.

UNIT I
INTRODUCTION TO MANAGERIAL ECONOMICS
Managerial Economics - Definition, nature and scope – contemporary importance of Managerial Economics - Demand Analysis: Determinants- Law of Demand - Elasticity of Demand. Significance – types – measurement of elasticity of demand - Demand forecasting- factors governing demand forecasting- methods of demand forecasting –Relationship of Managerial Economics with Financial Accounting and Management.

UNIT II
THEORY OF PRODUCTION AND COST ANALYSIS
Production Function – Short-run and long- run production - Isoquants and Isocosts, MRTS, least cost combination of inputs - Cobb-Douglas production function - laws of returns - Internal and External economies of scale - **Cost Analysis**: Cost concepts - Break-Even Analysis (BEA) - Managerial significance and limitations of BEA - Determination of Break Even Point (Simple Problems)

UNIT III
INTRODUCTION TO MARKETS AND NEW ECONOMIC ENVIRONMENT
Market structures: Types of Markets - Perfect and Imperfect Competition - Features, Oligopoly - Monopolistic competition. Price-Output determination - Pricing Methods and Strategies. Forms of Business Organization – Sole Proprietorship- Partnership – Joint Stock Companies – Public Sector Enterprises – New Economic Environment- Economic systems – Economic Liberalization – Privatization and Globalization

UNIT IV
CAPITAL AND CAPITAL BUDGETING
Concept of Capital - Over and Under capitalization – Remedial measures - Sources of Short term and Long term capital - Estimating Working Capital requirement – Capital budgeting – Features of Capital budgeting proposals – Methods and Evaluation of Capital budgeting – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

UNIT V
INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS
Financial Accounting – Concept - emerging need and importance - Double-Entry Book Keeping- Journal - Ledger – Trial Balance - Financial Statements - - Trading Account – Profit & Loss Account – Balance Sheet (with simple adjustments). Financial Analysis – Ratios – Techniques – Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

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B.Tech. III-II Sem. (M.E)	Th	Tu	C
	3	1	3

(13A52501) MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS (MEFA)

Course Objective:

The objectives of this course are to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to enrich analytical skills in helping them take sound financial decisions for achieving higher productivity.

Learning Outcome:

The thorough understanding of Managerial Economics and Analysis of Financial Statements facilitates the Technocrats – cum – Entrepreneurs to take-up decisions effectively and efficiently in the challenging Business Environment.

UNIT I

INTRODUCTION TO MANAGERIAL ECONOMICS

Managerial Economics - Definition, nature and scope – contemporary importance of Managerial Economics - Demand Analysis: Determinants- Law of Demand - Elasticity of Demand. Significance – types – measurement of elasticity of demand - Demand forecasting- factors governing demand forecasting- methods of demand forecasting –Relationship of Managerial Economics with Financial Accounting and Management.

UNIT II

THEORY OF PRODUCTION AND COST ANALYSIS

Production Function – Short-run and long- run production - Isoquants and Isocosts, MRTS, least cost combination of inputs - Cobb-Douglas production function - laws of returns - Internal and External economies of scale - **Cost Analysis**: Cost concepts - Break-Even Analysis (BEA) - Managerial significance and limitations of BEA - Determination of Break Even Point (Simple Problems)

UNIT III

INTRODUCTION TO MARKETS AND NEW ECONOMIC ENVIRONMENT

Market structures: Types of Markets - Perfect and Imperfect Competition - Features, Oligopoly - Monopolistic competition. Price-Output determination - Pricing Methods and Strategies. Forms of Business Organization – Sole Proprietorship- Partnership – Joint Stock Companies – Public Sector Enterprises – New Economic Environment- Economic systems – Economic Liberalization – Privatization and Globalization

UNIT IV

CAPITAL AND CAPITAL BUDGETING

Concept of Capital - Over and Under capitalization – Remedial measures - Sources of Short term and Long term capital - Estimating Working Capital requirement – Capital budgeting – Features of Capital budgeting proposals – Methods and Evaluation of Capital budgeting – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

UNIT V

INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS

Financial Accounting – Concept - emerging need and importance - Double-Entry Book Keeping- Journal - Ledger – Trial Balance - Financial Statements - - Trading Account – Profit & Loss Account –

Balance Sheet (with simple adjustments). Financial Analysis – Ratios – Techniques – Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

Text Books:

1. *Aryasri: Managerial Economics and Financial Analysis, 4/e, TMH, 2009.*
2. *Varshney & Maheswari: Managerial Economics, Sultan Chand, 2009.*

Reference Books:

1. *Premchand Babu, Madan Mohan: Financial Accounting and Analysis, Himalaya, 2009*
2. *S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International,. 2009.*
3. *Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.*
4. *Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2009.*
5. *H.L.Ahuja: Managerial* Economics, S.Chand, 3/e, 2009

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B.Tech. III-II sem. (M.E)	Th	Tu	C
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(13A03601) CAD/CAM

Course objective:
The objective of the this subject is to enable the students to understand and handle design problems in symmetric manner, gain practical experience in handling 2-D drafting and 3-D modeling software systems, apply CAD in real life applications, understand the concepts G and M codes and manual part programming and know the applications of CNC machines. Further the students will become familiar on principles of computer graphics, geometric modeling, NC and CNC machines, group technology and FMS.

UNIT I

Overview of CAD/CAM: Product cycle, CAD, CAM and CIM. CAD Tools, CAM Tools, Utilization in an Industrial Environment, Evaluation criteria. CAD standards, CAD data structure, Data base management systems.

Computer Graphics: Co-ordinate systems, Graphics package functions, 2D and 3D transformations, homogeneous transformations, clipping, hidden line / surface removal colour, shading.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the basic concepts Automation, components of CAD/CAM, input and output components of CAD, Steps involved in computer aided design.

UNIT II

Geometric Modeling: Representation techniques, Parametric and non parametric representation, various construction methods, wire frame modeling, synthetic curves and their representations, surface modeling, synthetics surfaces and their representations.

Solid modeling, solid representation, fundamentals, introduction to boundary representations, constructive solid geometry, analytical solid modeling.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the geometric model of the component in CAD technology of computer graphics. The techniques of raster technology, scan conversion, clipping, removal of hidden lines and hidden surfaces, color, shading and texture.

UNIT III

Numerical Control: NC, NC Modes, NC Elements, NC Machine tools and their structure, Machining centre, types and features. Controls in NC, CNC systems, DNC systems. Adaptive control machining systems, types of adaptive control.

CNC Part Programming: Fundamentals, NC word, NC Nodes, canned cycles, cutter radius compensation, length compensation, computed assisted part programming using APT: Geometry statements, motion statements, post process statements, auxiliary statements, macro statement program for simple components.

Learning outcomes & Suggested Student Activities:
Geometric Modelling constitutes the most important and complex part in most of CDA software packages. Hence the students should focus on various requirements of information that are generated during geometric modeling stage, various types and its applications. Mathematical representations of curves used in geometric construction.

UNIT IV

Group Technology & FMS: Part Family, Classification and Coding, advantages & limitations, Group technology machine cells, benefits. FMS: Introduction, components of FMS, material handling systems, Computer control systems, advantages.

Computer Aided Quality Control: Terminology in Quality control, Inspection and testing, Contact inspection methods - optical and non optical, integration of CAQC with CAD and CIM

Learning outcome & Suggested Student Activities:

CNC has revolutionized the manufacturing automation. The flexibility of manufacturing achvied with the use of CNC and associated Technology. The students should aimed to understand the principle of NC, CNC , Machining Centre and various methods of part programming. The student is advised to visit manufacturing industry where the CNC machines are using and also interact with CNC programmer in industry.

UNIT V

Computer Aided Processes Planning: Retrieval type and Generative type, benefits Machinability data systems, Computer generated time standards.

Computer integrated production planning: Capacity planning, shop floor control, MRP-I, MRP-II, CIMS benefits. Trends in Manufacturing systems: Concepts of Reconfigurable manufacturing, Sustainable manufacturing and lean manufacturing.

Learning outcomes & Suggested Student Activities:

Understanding the need of GT as a means of bringing the benefits of mass production to relatively smaller production. Understanding the need of computers in process planning and QC .Understanding the definition and concept of FMS, and its elements etc.

Text Books:

1. CAD/CAM, A Zimmers&P.Groover, PE, PHI

2. CAD/CAM-Principles and applications, P.N. Rao, TMH, 3rd edition, 2010

Reference Books:

1. Automation, Production systems & Computer integrated Manufacturing,Groover, P.E

2. CAD/CAM/CIM, Radhakrishnan and Subramaniah, New Age, 3rd edition, 2008

3. Principles of Computer Aided Design and Manufacturing, FaridAmirouche, Pearson

4. CAD/CAM Theory and Practice, R. Sivasubramaniam, TMH

5. Computer Aided Design and Manufacturing, K.Lalit Narayan , PHI, 2008.

6. Computer Aided Manufacturing, T.C. Chang, Pearson, 3rd edition, 2008

7. A text book of CAD/CAM, CSP Rao, Hitech Publ.

Web References:

http://www.cadcamfunda.com/cam_computer_aided_manufacturing

http://wings.buffalo.edu/eng/mae/courses/460-564/Course-Notes/cnc-classnotes.pdf

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(13A03602) MACHINE TOOLS

Course Objective:

The objectives of this course are to introduce to demonstrate the fundamentals of machining processes and machine tools.

To develop knowledge and importance of metal cutting parameters, tool materials, cutting fluids and tool wear mechanisms.

To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes and acquire knowledge on advanced manufacturing processes. The students will have the knowledge and hands-on experience that will enable them to work in a typical machine shop.

UNIT I

Elementary treatment of metal cutting theory – Elements of cutting process – Geometry of single point tool and angles, chip formation and types of chips – built up edge and its effects, chip breakers. Mechanics of orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, heat generation, tool life, coolants, machinability –economics of machining. cutting Tool materials and cutting fluids –types and characteristics .

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the basic concepts of the philosophy of metal cutting and the mechanism of chip formation. Student will understand the interface in the machining zone between the tool and the work piece and how the physical and mechanical parameters dictate the cutting performance.

UNIT II

Engine lathe – Principle of working- specification of lathe – types of lathes – work holders and tool holders –Taper turning, thread turning and attachments for Lathes.Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the basic concepts of turning. Student shall be made familiar with various tooling accessories used in turning and understand different constructions of lathe depending on the nature of operation.

UNIT III

Drilling and Boring Machines – Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring tools – machining time calculation.

Shaping, Slotting and Planning machines –Principles of working – Principal parts – specification, classification, Operations performed. Machining time calculations

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the basic principle of drilling, shaping and planning operation, parts of the drilling, shaping and planning machines and tool holding devices, operations performed on drilling, shaping and planning and machining calculations.

UNIT IV

Milling machine – Principles of working – specifications – classifications of milling machines – Principal features – machining operations, Types and geometry of milling cutters– methods of indexing – Accessories to milling machines.

Grinding machine –Theory of grinding – classification– cylindrical and surface grinding machine – Tool and cutter grinding machine – special types of grinding machines – Grinding wheel: Different types of abrasives – bonds, specification and selection of a grinding wheel. Static and dynamic balancing of a wheel Truing and Dressing of wheels. Lapping, Honing and Broaching machines – comparison of grinding, lapping and honing. machining time calculations.

Learning outcome &Suggested Student Activities:

After completion of this unit students are able to understand the principle of milling, grinding, Lapping, Honing and Broaching operation, parts of the milling machine and types of milling and grinding machines.

UNIT V

Principles of design of Jigs and fixtures and uses, 3-2-1 Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices, Typical examples of jigs and fixtures

Unit built machine tools – multispindle heads. power units-principal of working types of UBMTS, characterization, applications

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the design of Jigs and fixtures and uses, Classification of Jigs & Fixtures – Principles of location and clamping. Some examples of jigs and fixtures. The outcome of this unit is to understand the basic principle of unconventional machining methods USM,AJM,EDM,LBM,EBM,CM and ECM and machining of the USM,AJM,EDM,LBM,EBM,CM and ECM.

Text Books:

1. *Workshop Technology – Vol II, B.S.RaghuVamshi, Dhanpat Rai & Co, 10th edition, 2013*
2. *Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition, 2012*

Reference Books:

1. *Manufacturing Technology-Kalpakzian- Pearson*
2. *Metal cutting Principles by Milton C.Shaw, oxford Second Edn, 2nd edition, 2012*
3. *Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1st edition, 2001*
4. *Production Technology by K.L.Narayana, IK International Pub.*
5. *Unconventional Machining process by V.K.Jain, Allied Pub.*
6. *manufacturing technology Vol II by P.N. Rao, Tata McGraw Hill, 4th edition, 2013*
7. *Machining and machine tools by AB. Chattopadyay, WileyEdn,2013*
8. *Machine Technology Machine tools and operations by Halmi A Yousuf&Harson, CRC Press Taylor and Francies .*

Web Resources:

www.hgfarley.com
www.kennametal.com/ - United States
www.mini-lathe.com/links.htm;machinedesign.com/.../designer-s-guide-tometalcutting-machinery-0608 -
www.metalwebnews.com/wc.html
www.britannica.com/EBchecked/topic/463000/planer www.americanmachinist.com
www.machinetools.net.tw/parts/taiwan_voltage_regulator.htm

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(13A03603) REFRIGERATION AND AIR CONDITIONING

Course Objective:

This subject provides insights in how thermodynamic principles are applied within the refrigeration and air conditioning industry. It gives details on how different components work and influence each other. Students will learn how real systems used in commercial , industrial refrigeration and air conditioning industries are built-up.

The objective this subject is to make the student to have complete knowledge on various refrigeration methods like VCR, VAR and latest developments, knowledge on various air conditioning methods like summer, winter and year round air conditioning and to make the student to understand the practical applications of refrigeration and air conditioning systems.

UNIT I

Introduction to Refrigeration: Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit of Refrigeration, COP, EER, Different Refrigeration Methods

Air Refrigeration: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems - Numerical Problems – Refrigeration Needs of Air Crafts.

Learning Outcome & Suggested Student Activities:

At the end of the chapter, student can able to understand the terminologies associated with refrigeration and also understand the basic principles of Refrigeration and applications. Student can also know the aspects of various natural refrigeration methods; understand the components of Air refrigeration system and the necessity of air craft refrigeration.

The following URLs are very useful to the students

http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/RAC%20%20 Lecture%201.pdf

http://www.ignou.ac.in/upload/Unit%201-32.pdf , http:/nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20 Cond/pdf/RAC%20 Lecture%209.pdf

UNIT II

Vapour Compression Refrigeration (VCR) System – Basic Cycle - Working Principle and Essential Components of The Plant – COP – Representation of Cycle On T-S and P-h Charts – Expander Vs. Throttling, Effect of Sub Cooling and Super Heating – Cycle Analysis – Actual Cycle- Influence of Various Parameters on System Performance – Construction and Use of P-h Charts – Numerical Problems.

Refrigerants – Desirable Properties – Classification of Refrigerants Used – Nomenclature- Secondary Refrigerants- Lubricants – Ozone Depletion – Global Warming- Newer Refrigerants.

Learning Outcome & Suggested Student Activities:

After the completion of the chapter, student can know the purpose and function of each of the components in the domestic refrigerator, analyzing the concepts of sub-cooling and super heating to improve the COP and also necessity of replacements for CFCs and HCFCs with new refrigerants.Following URLs are highly useful to the students

http://www.nptel.iitm.ac.in/courses/IITMADRAS/Applied_Thermodynamics/Module_6/6_Simple_Vapor_Compression_RS.pdf

http://www.mcquay.com/mcquaybiz/literature/lit_ch_wc/AppGuide/AG31-007.pdf

UNIT III

Vapor Absorption Refrigeration (VAR) System – Description and Working of NH_3 – Water System and Li Br –Water (Two Shell & Four Shell) System -Calculation of Max COP, Principle of Operation of Three Fluid Absorption System.

Steam Jet Refrigeration System: Working Principle and Basic Components-Estimation of Motive Steam Required, Principle and Operation of: (I) Thermo-Electric Refrigerator (Ii) Vortex Tube OrHilsch Tube.

Learning Outcome & Suggested Student Activities:

After the completion of the chapter, student can know the purpose and function of each of the basic components of the absorption refrigeration system. Student can have knowledge on latest developments of Electrolux, thermo electric vortex tube methods. Following URLs are highly useful to the students

http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/RAC%20Lecture%2014.pdf

http://en.wikipedia.org/wiki/Thermoelectric_cooling

UNIT IV

Introduction to Air Conditioning: Psychrometric Properties & Processes – Characterization of Sensible and Latent Heat Loads — Need For Ventilation, Consideration of Infiltrated Air – Heat Load Concepts.

Air Conditioning Systems: Air Cooler (Evaporative Cooling) ,Window, Split, Summer , Winter, Year Round, Central Air Conditioning Systems.

Learning Outcome & Suggested Student Activities:

After the end of the chapter, student can have knowledge on the use of psychrometric terms in Air conditioning. Student can learn the use of psychrometric chart to know psychrometric properties of air. Student can able to understand the terms sensible heat load and latent heat load. This technical information is fundamental to all types of domestic, commercial and industrial systems for the calculations of heat loads.

Student is advised to conduct experiment on A.C tutor in the laboratory. Following URLs are highly useful to the students

http://server.fst.uga.edu/kerr/FDST%204060/pdf%20files/7%20Psychrometrics.pdf

http://people.eng.unimelb.edu.au/mjbrear/436-432/chapter%208%20-%20psychrometry.pdf

http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/R&AC%20Lecture%2031.pdf

UNIT V

Air Conditioning Equipment - Humidifiers – Dehumidifiers – Air Filters, Fans and Blowers.

Human Comfort: Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart.Heat Pump – Heat Sources – Different Heat Pump Circuits.

Learning Outcome & Suggested Student Activities:

After the completion of the chapter, student can understand the components of A/C system and describe the cooling equipment combinations. Student can describe the concept of human comfort chart and the processes by which the body produces and rejects heat. Student can be familiar with the Heat pump circuit analysis. Following URLs are highly useful to the students

Effective temp- http://nptel.iitm.ac.in/courses/Webcourse contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/R&AC%20Lecture%2029.pdf

http://courses.washington.edu/me333afe/Comfort_Health.pdf

http://web.me.unr.edu/me372/Spring2001/Heat%20Pumps.pdf

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Text Books:

1. *Refrigeration and Air Conditioning ,CP Arora,TMH, 13th edition, 2013.*
2. *A Course in Refrigeration and Air conditioning,S.CArora&Domkundwar, Dhanpatrai*

Reference Books:

1. *Refrigeration and Air Conditioning / Manohar Prasad / New Age, 2nd edition, 2013*
2. *Principles of Refrigeration - Dossat / Pearson Education, 4th edition, 2007.*
3. *Refrigeration and Air Conditioning-P.L.Ballaney, 2nd edition, 2012.*
4. *Basic Refrigeration and Air-Conditioning – P.N.Ananthanarayanan / TMH, 4th edition, 2013.*

NOTE: *Tables/Codes: Thermal Engineering Data Book containingRéfrigérant and Psychrometric property Tables and charts are permitted in Exam*

Suggestions:

The entire syllabus is covered in the text book –" A Course in Refrigeration and Air conditioning " by Domkundwar, Arora, Dhanpatrai Publications (Highly useful book for GATE exam and other Government /Private sector competitive examinations)

Students can visit the nearby small scale Industries like Ice Plants to understand the principles of production of Ice and to observe the other simple components for practical understanding. Student is also advised to visit domestic refrigerator manufacturing industries/ Centralized and Split A/C system units.

Students are advised to watch the video lectures in the website - ***http://nptel.iitm.ac.in***

The fundamental concepts of Thermodynamics, Psychrometrics etc., are required for better understanding of this subject.

Web Resources:

http://www.refrigerationbasics.com/index.htm http://www.howstuffworks.com/ac.htm
http://www.ashrae.org
http://www.taftan.com/thermodynamics/AIRCOND.HTM
http://www.wisegeek.com/how-does-air-conditioning-work.htm

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(13A03604) DESIGN OF MACHINE MEMBERS– II

Course Objective:
To aware the student about basic concepts of curved beams with different cross sections, design of power transmission elements, understand the design concepts of various types of springs, various types of bearings and gears.
To know the students how to apply design concepts in designing of IC engine parts like Piston, cylinder, connecting rod and crank shaft.

UNIT I

DESIGN OF CURVED BEAMS: Stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section. Design of crane hooks, C –clamps.
DESIGN OF POWER TRANSMISSIONS SYSTEMS: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes, design procedure for chain drives.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to design crane hooks, C-clamps and various belt, rope and chain drives. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of power transmission elements.
http://machinedesign.com/
http://www.youtube.com/watch?v=PEKfS2Q1WqM&list=PL3D4EECEFAA99D9BE&index=19
http://www.youtube.com/watch?v=nMsB6Soz4Hc&list=PL3D4EECEFAA99D9BE&index=30

UNIT II

DESIGN OF MECHANICAL SPRINGS: Stress and deflections of helical Springs-Springs for fatigue loading – Natural frequency of helical springs-Energy storage capacity- Helical Torsion springs- Design of leaf springs.
DESIGN OF POWER SCREWS: Design of screw- Square, ACME and Buttress screws- Efficiency of the screw. Design of compound screw, differential screw, ball screw- possible failures

Learning Outcome & Suggested Student Activities:
After completion of this unit, students are able to design helical sprigs for two wheel vehicle and laminated springs for trucks. Also students can apply design concepts in designing power screws. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of springs and power screws.
http://machinedesign.com/
http://www.youtube.com/watch?v=PEKfS2Q1WqM&list=PL3D4EECEFAA99D9BE&index=19
http://www.youtube.com/watch?v=46quOD7V- cQ&list=PL3D4EECEFAA99D9BE&index=28

UNIT III

DESIGN OF BEARINGS: Types of Journal bearings – Lubrication – Bearing Modulus–bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life – Failure of bearings.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to design journal bearings, ball bearings and roller bearings and to know the advantages of rolling contact bearings against sliding contact bearings. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of bearings.
http://machinedesign.com/
http://www.mae.ncsu.edu/klang/courses/mae442/Tranmission/Journal%20Bearing.ppt
http://nhbb.com/files/catalog_pages/HiTech_Catalog.pdf

UNIT IV

DESIGN OF SPUR & HELICAL GEARS: Spur gears- Helical gears – Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of spur and Helical gears – Estimation of centre distance, module and face width. Check for dynamic and wear considerations.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to design spur and helical gears for different input conditions. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of gears.
http://machinedesign.com/
http://nptel.iitm.ac.in/courses/IIT-MADRAS/Machine_Design_II/pdf/2_9.pdf
http://www.youtube.com/watch?v=8bml2pK6Ra0

UNIT V

DESIGN OF IC ENGINE PARTS: Pistons– Construction, Design of piston. Cylinder, Cylinder block, Connecting Rod. Cranks and Crank shafts- Center and over hung cranks.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to know various forces acting on I C engine parts and failure criteria to be adopted for various parts. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of IC Engine parts.
http://machinedesign.com/
http://umpir.ump.edu.my/1778/1/Design_Of_Cooecting_Rod_Of_Internal_Combustion_Engine_A_Topology_Optimization_Approach.pdf
http://www.d-p.com.gr/pistons/piston-designs.html

Text Books:

1. *MechanicalEngineeringDesign,JosephE.Shigely,TMH Publishers,NewDelhi, 9th edition, 2010.*
2. *Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.*

Reference Books:

1. *MachineDesign,Schaum'sseries,TMHPublishers, NewDelhi, 1st edition, 2011*
2. *Design ofMachine Elements, V.B.Bhandari , TMH Publishers,NewDelhi, 2nd edition, 2013.*
3. *MachineDesign,SadhuSingh,KhannaPublishers, NewDelhi*
4. *DesignofMachineElements,M.F.Spotts,PHIPublishers, NewDelhi.*
5. *MachineDesign,PandyaandShah,CharotarPublishers,Anand, 17th edition, 2012.*

NOTE: *Design data books are permitted in the examinations.*
Web References:

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http://www.uni.edu/~rao/Md-17%20Shaft%20Design.pdf
http://www.uni.edu/~rao/Md-13%20Keys%20and%20Couplings.pdf
http://etidweb.tamu.edu/ftp/ENTC463/Notes/ENTC463Key%20and%20Coupling.pdf
http://www.science.howstuffworks.com/transport/engines.../bearing1.html
http://www.fi.edu/time/Journey/Time/Escapements/gearint.html

Suggestions:

1. students may visit nearby automobile workshops and machine tool shops to know about different machine elements like gears, bearings, springs, power screws, flexible drives and I C engine parts.

2. In addition to the text books students may also go through the reference books authored by V.B. Bhandari, by Pandya and Shah for more number of numerical problems.

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(13A03605) NONCONVENTIONAL SOURCES OF ENERGY

Course Objective:

To create awareness to the student about basic concepts of non-conventional source of energy, to understand the process of collection, storage, conversion and applications of Solar Energy, Wind Energy, Bio Mass, OTEC. To learn about direct conversion methods.

UNIT – I

PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solarenergy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrialand terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT-II

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT-III

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, Sensible, latent heat andstratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

UNIT-IV

BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gasyield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential inIndia.

UNIT-V

OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidaland wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, and principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications,

MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

Outcomes:

- *Understanding various Non-conventional sources of Energy.*
- *Able to learn how to use renewable energies instead of conventional fuels.*

TEXT BOOKS:

1. *Renewable energy resources/ Tiwari and Ghosal/ Narosa.*
2. *Non-Conventional Energy Sources /G.D. Rai*

REFERENCES :

1. *Renewable Energy Sources/ Twidell & Weir*
2. *Solar Energy/ Sukhatme*
3. *Solar Power Engineering/B.S.Magal Frank Kreith & J.F.Kreith.*
4. *Principles of Solar Energy/ Frank Krieth & John F Kreider.*
5. *Non-Conventional Energy/ Ashok V Desai/ Wiley Eastern*
6. *Non-Conventional Energy Systems/ K Mittal / Wheeler.*

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(13A03606) TOTAL QUALITY MANAGEMENT

Course Objective:

To understand the concept of quality, cost of quality, international quality standards.
To learn the principles of Total quality management, techniques for problem solving.
To learn about various tools of quality management used in various industrial applications.

UNIT – I

TQM – overview , concepts, elements – History-Quality management philosophies-Juran, Deming, Crosby , Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement – objectives – internal and external customers.
Quality standards – Need of standardization - Institutions – bodies of standardization, ISO 9000 series – ISO 14000 series – other contemporary standards – ISO certification process-Third party audit.

UNIT – II

Process management- Quality measurement systems (QMS) – developing and implementing QMS – nonconformance database- TQM tools & techniques- 7 QC tools- 7 New QC tools.
Problem Solving techniques - Problem Solving process – corrective action – order of precedence

UNIT – III

System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis.
Quality circles – organization – focus team approach – statistical process control – process chart – Ishikawa diagram – preparing and using control charts.

UNIT IV

Quality Function Development (QFD) – elements of QFD – benchmarking-Types- Advantages & limitations of benchmarking – Taguchi Analysis – loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

UNIT – V

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management.
Six sigma approach – application of six sigma approach to various industrial situations.

Outcomes:

- Understanding the concepts of TQM.
- Able to use tools and techniques for problem solving.
- To formulate quality circles to find solutions to problems in industry.
- Analyze various quality problems and contribute towards continuous improvement in the system.

TEXT BOOKS:

1. Total Quality Management by Joseph & Susan Berg
2. Total Quality Management by Besterfield, Pearson.

REFERENCE BOOKS:

1. Quality management by Howard Giltow-TMH
2. Quality management by Evans.
3 Quality management by Bedi

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(13A03607) MECHATRONICS

Course Objective:
To make the students to learn about the
Basic electronics, electrical and mechanical components used to control the machines and industries.
Various types of sensors, signal conditioning systems and various pneumatic and hydraulic components used in control systems.
Micro controllers, PLCS and PLC program and programmable motion control systems.

UNIT I

INTRODUCTION: Definition – Trends - Control Methods: Stand alone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

Learning outcome &Suggested Student Activities:
This unit helps the students to understand the importance of mechatronicssubject and controlling the various machines, robots etc. Students may observe CNC machines in CAD/CAM lab to understand the mechatronics concepts.
Student may refer text book - Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, Chapter- 1, by the authors - W .Bolton, publishers - Pearson Education Press, 3rd edition, 2005.
Students may refer the following website www.nptel.iitm.ac.in/ECE/mechatronics www.ustudy.in/mech/mechs en.wikipedia.org/wiki/mechatronics for better understanding of this topic.

UNIT II

SIGNAL CONDITIONING: Introduction – Hardware - Digital I/O , Analog input – ADC , resolution , speed channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering.

Learning outcomes & Suggested Student Activities:
This unit helps the students to understand how to convert the analog signals into useful required form. These signal condition systems may be observed in electronics and communication engineering department labs.
Student may refer text book - Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, Chapter – 3, by the authors - W Bolton, publishers- Pearson Education Press, 3rd edition, 2005.
Students may refer the following website www.nptel.iitm.ac.in/ECE/mechatronicswww.saylor.org/corses/me302__for better understanding of this topic

UNIT III

PRECISION MECHANICAL SYSTEMS: Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Bearings- Motor / Drive Selection.

Learning outcome & Suggested Student Activities:
In this unit the students learn about the pneumatic and hydraulic systems and about some precisions mechanical component which are useful in the field of automation. This automation system can be observed in many processing industries and manufacturing industries to handle the materials and control the machines (or) process. Student may refer text book - Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, Chapter-5, 6 & 7 by the authors - W .Bolton, publishers - Pearson Education Press, 3rd edition, 2005.Students may refer the following website www.pic-design.com, www.sdp-si.com, www.csio.res.in,

UNIT IV:

ELECTRONIC INTERFACE SUBSYSTEMS: Motors Isolation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers, over current sensing, resettable fuses, Power Supply - Bipolar transistors/ mosfets.

ELECTROMECHANICAL DRIVES: Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - PWM's - Pulse Width Modulation – Variable Frequency Drives.

Learning outcome & Suggested Student Activities:

The objective of this unit is to make the student aware of electronic systems, electromechanical drives used in automation. Some of the systems may be observed electrical and electronics labs for better understanding. Student may refer text book - Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, Chapter- 7 by the authors – W. Bolton, publishers- Pearson Education Press, 3rd edition, 2005.Students may refer the following website www.pic-design.com, www.sdp-si.com, www.csio.res.info better understanding of this topic.

UNIT V

MICROCONTROLLERS OVERVIEW: 8051 Microcontroller , micro processor structure - Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors – Applications, Programming –Assembly.

PROGRAMMABLE LOGIC CONTROLLERS: Basic Structure - Programming: Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection, interface – R232 etc.,-Applications.

Learning outcome & Suggested Student Activities:

This unit helps the student to know about microcontrollers and to programming of programmable logic controls. Students may visit pharmaceutical industries, thermal power plants etc. To observe the PLC based control systems. to know about the interface between processing equipment and central system.

Student may refer text book - Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, Chapter- 13, 14 & 19 by the authors - W .Bolton, publishers- Pearson Education Press, 3rd edition, 2005.Students may refer the following website www.authorstream.com, www.atmel.in, www.lifehacker.com

Text Books:

1. *Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering , W Bolton, Pearson Education Press, 3rd edition, 2005.*
2. *Mechatronics, M.D.Singh, J.G.Joshi, PHI.*

Reference Books:

1. *Mechatronics Source Book, Newton C Braga, Thomson Publications, Chennai.*
2. *Mechatronics, N. Shanmugam, Anuradha Agencies Publisers.*
3. *Mechatronics System Design, Devdas shetty,Richard,Thomson.*

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(13A03608) CAD LAB

COMPUTER AIDED DRAFTING (CAD)

LIST OF EXPERIMENTS:

I Introduction to CAD software
II. 2D drafting using Auto CAD (Two exercises)
III. 3D modeling using Auto CAD (Any four exercises)

Introduction to 3D Modeling Using Autocad Software

1. Modeling of Component in 3D – V block
2. Modeling of Component in 3D – Open Bearing
3. Modeling of Component in 3D – Angular block
4. Modeling of Component in 3D – Dovetail Guide
5. Modeling of Component in 3D – Dovetail Bracket
6. Modeling of Component in 3D – Dovetail stop
7. Geometric Modeling Using Pro-E or CATIA or solid works or iron CAD (Any four exercises)

Assembly Modeling: Student must do at least two exercises

1. Assembly of a screw jack parts
2. Assembly of a knuckle joint
3. Assembly of a Oldham's coupling
4. Assembly of a footstep bearing
5. Assembly of a stuffing box
6. Assembly of a square tool post

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(13A03609) MACHINE TOOLS LAB

1. Demonstration of construction & operations of general purpose machines: Lathe, Drilling machine, Milling machine, Shaper, Planning machine, Slotting machine, Cylindrical Grinder, Surface grinder and Tool & cutter grinder.
2. Job on Step turning and taper turning on lathe machine
3. Job on Thread cutting and knurling on -lathe machine.
4. Job on Drilling and Tapping
5. Job on Shaping and Planning
6. Job on Slotting
7. Job on Milling (groove cutting/ gear cutting)
8. Job on Cylindrical and Surface Grinding
9. Job on Grinding of Tool angles.

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3

(13A52502) ADVANCED COMM. SKILLS LAB (AUDIT COURSE)

Introduction:

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- *Gathering ideas and information to organise ideas relevantly and coherently.*
- *Engaging in debates.*
- *Participating in group discussions.*
- *Facing interviews.*
- *Writing project/research reports/technical reports.*
- *Making oral presentations.*
- *Writing formal letters.*
- *Transferring information from non-verbal to verbal texts and vice-versa.*
- *Taking part in social and professional communication.*

Course Objective:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- *To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.*
- *Further, they would be required to communicate their ideas relevantly and coherently in writing.*
- *To prepare all the students for their placements.*

Learning Outcome:

- *Accomplishment of sound vocabulary and its proper use contextually*
- *Flair in Writing and felicity in written expression.*
- *Enhanced job prospects.*
- *Effective Speaking Abilities*

The following course content to conduct the activities is prescribed for the Advanced English Language Communication Skills (AELCS) Lab:

UNIT I

COMMUNICATIVE COMPETENCY

1. Reading Comprehension
2. Listening comprehension
3. Vocabulary for competitive purpose
4. Spotting errors

UNIT II
TECHNICAL WRITING

1. Report writing
2. Curriculum vitae
3. Covering letter
4. E-mail writing

UNIT III
PRESENTATIONAL SKILLS

1. Oral presentation
2. Power point presentation
3. Poster presentation
4. Stage dynamics

UNIT IV
CORPORATE SKILLS

1. Dress code
2. Telephonic skills
3. Net Etiquettes

UNIT V
GETTING READY FOR JOB

1. Group discussions
2. Interview skills
3. Psychometric tests

Minimum Requirement:
The Advanced English Language Communication Skills (AELCS) Laboratory shall have the following infra-structural facilities to accommodate at least 60 students in the lab:

- *Spacious room with appropriate acoustics.*
- *Round Tables with movable chairs*
- *Audio-visual aids*
- *LCD Projector*
- *Public Address system*
- *P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ*
- *T. V, a digital stereo & Camcorder*
- *Headphones of High quality*

Suggested Software:
The software consisting of the prescribed topics elaborated above should be procured and used.
K-VAN SOLUTIONS-Advanced communication lab

1. *DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.*
2. *TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)*
3. *Train2success.com*

References:

1. *Objective English For Competitive Exams, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.*
2. *Technical Communication by Meenakshi Raman & Sangeeta Sharma, O U Press 2009.*
3. *Books on TOEFL/GRE/GMAT/CAT/ IELTS by Barron's/DELTA/Cambridge University Press.2012.*
4. *Soft Skills for Everyone, Butterfield Jeff, Cengage Publications, 2011.*
5. *Practice Psychometric Tests: How to familiarize yourself with genuine recruitment tests, 2012.*
6. *Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.*
7. *Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.*
8. *English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.*
9. *Word Power Made Handy, Shalini Verma, S Chand Publications, 2011.*
10. *Effective Technical Communication, Ashrif Rizvi, TataMcGrahill, 2011.*

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(13A03701) OPERATIONS RESEARCH

Course Objective:
The subject should enable the students to the nature and scope of various decision making situations within business contexts, understand and apply operation research techniques to industrial applications,
To make the student capable of Formulating the various real life decision making problems as Mathematical programming problems. Students to learn the fundamental Techniques of Operations Research and to choose a suitable OR technique to solve problem on hand.

UNIT I
Introduction to OR and Linear Programming-1
OR definition– Classification of Models –Types of Operations Research models;
Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Two–Phase Simplex Method, Big-M Method - Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions;

Learning Outcome & Suggested Student Activities:
At the end of the Unit, the student will be able to create mathematical models of the real life situations and capable of obtaining best solution using Graphical Method and Simplex Method.
(The student must refer to any of the text books and practice solving several problems as it is very common to make mistakes while solving due to lack of practice). The student should take up a real life problem and formulate it as a mathematical programming problem.
Further, the students may visit the following URL for live online tutorial for LPP formulation
http://www.www.mathsdoctor.tv

UNIT II
Linear programming-2: Duality- Principle, Economic Interpretation of Duality, Dual Simplex Method
Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution- North-West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Methods-Stepping Stone Method and Modified Distribution (MODI) Method; Special Cases - Unbalanced Transportation Problem, Degenerate Problem;
Assignment Problem – Formulation; Optimal Solution -Traveling Salesman problem.

Learning Outcome &Suggested Student Activities:
At the end of this Unit, the student must be able to implement the theory of duality for simplifying the solution procedure for certain LPPs, and solve the special cases of LPP such as Transportation and Assignment problems. A large number of problems are to be solved by the student in order to gain much required capability of handling the problems without mistakes.
The following URLs will be useful to the students for in-depth knowledge
http://nptel.iitm.ac.in/video.php?subjectId=112106134,
http://www. Math.harvard.edu/archive/20_spring_05/handouts

UNIT III
Game Theory: Introduction – Minimax (Maximin) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy –Games with Mixed Strategies – 2 X 2 Games – Dominance Principle– Solution by Graphical Method of m X 2 & 2 X n games

Queuing Theory: Introduction –Terminology, Service Channel, Arrival Pattern, Population, Departure Pattern(Service Pattern), Queue Discipline, Birth & Death Process, Balking, Reneging, Jockeying; Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non finite queue length.

Learning Outcome & Suggested Student Activities:
At the end of this Unit, the student will have knowledge of choosing the best strategy out of the available strategies which is an essential skill for any business manager to successfully face the competition. The following web link will direct the students to the video lecture on Game Theory.
http://www.youtube.com/watch?feature=player_detailpage&v=h0bdo06qNVw
The student will be capable of identifying the suitable Queuing Model for real world waiting lines and make estimations like Average Waiting Times, Average Queue Length, Probability of Waiting in the queue etc.
The students may watch the following web video for better understanding of the subject.
http://www.youtube.com/watch?feature=player_detailpage&v=xGkpXk-AnWU#t=104s
The students should refer to any OR text book for more number of practice problems.

UNIT IV

Sequencing -Assumptions-n-jobs-2 Machines model, n-jobs-3-machines models.

PERT & CPM: Introduction to Project Management, Activities, Events, Predecessor Relationships, AOA Diagram, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float

CPM- Deterministic Model- Critical Path, Crashing, Optimal Project Duration, Least Possible Project Duration

PERT- Probabilistic Model- Various types of Activity Time Estimates, Standard Deviation and Variance of the Activities and Projects, and Probability of Completing the Project within scheduled time

Learning Outcome & Suggested Student Activities:
At the end of this Unit, student will be able to represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project, Probabilities of completing Projects as per schedule etc by applying either CPM or PERT technique as per the suitability.
The following URL will lead us to a video lecture on this Unit
http://www.youtube.com/watch?feature=player_detailpage&v=H58TPQNr2kM

UNIT V

Dynamic Programming : Introduction – Bellman's Principle of Optimality – Applications of Dynamic Programming- Capital Budgeting Problem – Shortest Path Problem – Solution of Linear Programming Problem by DP.

Replacement and Maintenance Analysis: Introduction – Types of Maintenance, Types of Replacement Problem, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

Learning Outcome & Suggested Student Activities:
At the end of this Unit, the student will be aware of applying Dynamic Programming technique to solve the complex problems by breaking them into a series of sub-problems. The following URL contains a video lecture on Dynamic Programming and the students are advised to go through
http://www.youtube.com/watch?feature=player_detailpage&v=ug7O1lSZyg0
Further, the student will gain knowledge in different types of maintenance, failure patterns and the economic replacement policies which are very much important for the continuous functioning of machinery in an organization. The students may visit the following websites for better understanding

of the subject.
http://www2.ensc.sfu.ca/undergrad/courses/ENSC201/Unit09/lecture9.html
http://pakaccountants.com/what-is-depreciated-replacement-cost/

Text Books:

1. *Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013.*
2. *Operation Research, J.K.Sharma,Trinity Press, 6th edition.*

Reference Books:

1. *Operations Research, Dr. C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers*
2. *Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.*
3. *Operations Research, Pradeeo J Jha, Mc Graw Hill,2015*
4. *Operations Research, S.R.Yadav, A.K.Malik, Oxford, 2015*
5. *Operations Research, A.M.Natarajan,P.Balasubramani,A. Tamilarasi,Pearson Education, 8th edition, 2011.*

Web References:

http://www2.informs.org/Resources/
http://www.mit.edu/~orc/
http://www.ieor.columbia.edu/
http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm
http://www.wolfram.com/solutions/OperationsResearch/
http://nptel.iitm.ac.in/video.php?subjectId=112106134

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(13A03702) AUTOMATION AND ROBOTICS

Course Objective:
The subject should enable the students to understand the principles of automation, importance of automated flow lines and its types.
To learn the concepts of Robotics, kinematics of robot, principles of robot drives and controls, sensors used in robots and programming methods.

UNIT I

Introduction to Automation: Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation.
Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand to know what is automation, types of automation, components of automation, strategies and levels of automation. Student is advised to visit URLs http://www.nptel.iitm.ac.in/and iitb.ac.in ,
http://www.learnerstv.com/video/Free-video-Lecture-30103-Engineering.htm for video lectures.

UNIT II

Automated flow lines: Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines.
Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the types of flow lines, quantitative analysis of flow lines, how the assembly is carried out on automated flow line without interruption and how to balance the line and flexible assembly lines. Student is advised to visit URLs http://www.nptel.iitm.ac.in/and iitb.ac.in,
http://www.learnerstv.com/video/Free-video-Lecture-30103-Engineering.htm for video lectures.

UNIT III

Introduction to Industrial Robotics: Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.
Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

Learning outcome & Suggested Student Activities:
Student should come to know the various components in the anatomy of robot. By knowing this the student may apply in the design of new robotic structure. Student is advised to visit URLs http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv071-Page1.htm

UNIT IV

Manipulator Kinematics: Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.
Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton - Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the applications of various types of end effectors, and sensor devices. Student should also learn about the homogeneous transformations and its applications in the analysis of a robotic structure and method of developing different types of mechanisms and kinematics of the robot. Student is advised to visit URLs http://www.nptel.iitm.ac.in , http://www .iitb.ac.in , http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv071-Page1.htm

UNIT V
Robot Programming: Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages.
Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand robot programming languages which may adopt in different applications of robot. Student also knows the control motion mechanism in all devices of robot and application of robots in manufacturing sector. Student is advised to visit URLs http://www.nptel.iitm.ac.in/and iitb.ac.in, http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv071-Page1.htm

Text Books:

1. *Automation , Production systems and CIM,M.P. Groover/Pearson Edu.*
2. *Industrial Robotics - M.P. Groover, TMH.*

Reference Books:

1. *Robotics , Fu K S, McGraw Hill, 4th edition, 2010.*
2. *An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.*
3. *Robotic Engineering , Richard D. Klafter, Prentice Hall*
4. *Robotics, Fundamental Concepts and analysis – AshitaveGhosal,Oxford Press, 1/e, 2006*
5. *Robotics and Control , Mittal R K &Nagrath I J , TMH.*
6. *Introduction to Robotics – John J. Craig,PearsonEdu*

Web References:
http://www.cadcamfunda.com/cam_computer_aided_manufacturing
http://wings.buffalo.edu/eng/mae/courses/460-564/Course-Notes/cnc-classnotes.pdf
http://nptel.iitm.ac.in/courses.php?branch=Mechanical
http://academicearth.org/courses/introduction-to-roboticsVideo references:-http://nptel.iitm.ac.in/video.php?courseId=1052

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(13A03703) FINITE ELEMENT METHODS

Course objective:
The subject should enable the students to learn the principles involved in discretization in finite element approach, form stiffness matrices and force vectors for simple elements, find the various approach followed in finite element approach, use the various elements for discretization and learn about shape functions.
To learn the application of FEM to various structural problems incorporating temperature. and boundary conditions and heat transfer problems.

UNIT I

INTRODUCTION: Equilibrium equations in elasticity subjected to body force, traction forces and point loads, stress strain relations in 3D elasticity, plane stress and plane strain, Boundary conditions, Initial conditions. Governing equation for Steady state heat conduction with convective boundary conditions.

Approximate methods for solving the differential equations: Rayleigh-Ritz method, Weighted residual methods, Galerkin's method.

Integral formulation: Principle of a minimum potential energy, principle of virtual work, Generalized Finite element approach in solving these problems.

Solution methods for solving simultaneous equations.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to know introductory basic principles and approaches for solving FEM problems in different fields. In addition to text books, the following URLs will be highly useful to the students to understand basic approaches to formulate and solving of FEM problems.
http://www.youtube.com/watch?v=NYiZQszx9cQ&list=PLA4CBD0C55B9C3878&index=1
http://www.youtube.com/watch?v=RQBXWF9b-Fs&list=PLA4CBD0C55B9C3878

UNIT II

Problems with One-dimensional geometry:

Bars: Formulation of stiffness matrix, Load vectors, Incorporation of boundary conditions: Elimination approach and penalty approach.

Trusses: Plane truss and space truss elements, Example problems involving plane truss elements. Examples involving multipoint constrains. Stress calculations.

Beams & Frames: Bending of beams, Interpolation functions, formulation of stiffness matrix and load vectors. Plane frames, space frames. Transformations of stiffness and load vectors.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to formulate FEM model for simple problems. In addition to text books, the following URLs will be highly useful to the students to formulate FEM models for simple problems using different elements.
http://web.iitd.ac.in/~achawla/public_html/429/fem/overview.pdf
http://www.cmmacs.ernet.in/cmmacs/Lect_notes/sangeeta1.pdf
http://www.mecheng.iisc.ernet.in/~suresh/me237/fea/Chapter4.pdf

UNIT III

INTERPOLATION MODELS: Polynomial form of interpolation functions - linear, quadratic and cubic, simplex, complex, Multiplex elements, Selection of the order of the interpolation polynomial,

Convergence requirements, 2D Pascal Triangle, Linear interpolation polynomials in terms of global coordinates for triangular (2D simplex) elements, Linear interpolation polynomials in terms of local coordinates for triangular (2D simplex) elements, quadrilateral element.
HIGHER ORDER AND ISOPARAMETRIC ELEMENTS: Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Shape functions of 2D quadratic triangular element in natural coordinates, 2D quadrilateral element shape functions – linear, quadratic, Biquadric rectangular element Tetrahedral and hexahedral elements.

Learning Outcome &Suggested Student Activities:
After completion of this unit students are able to write interpolation functions to higher order isoparametric elements. In addition to text books, the following URLs will be highly useful to the students to understand basic concepts of isoparametric elements.
http://www.kochmann.caltech.edu/ae108a/IsoparametricElements.pdf
http://www.me.mtu.edu/~bettig/MEEM4405/Lecture08.pdf
http://site.iugaza.edu.ps/marafa/files/FEM-Chapter-10.pdf

UNIT IV
FINITE ELEMENT APPLICATION IN SOLID MECHANICS:
Problem modeling and Finite element analysis in 2D plane elasticity with triangular and quadrilateral elements, Isoparametric, subparametric and superparametric elements. Interpolation, Jacobian, matrices relating strain and nodal displacements, stiffness matrix formulation, Consistent and lumped load vectors, Numerical integration Gaussian quadrate.
Axi-symmetric triangular elements: formulation of stiffness and load vectors.
Introduction to 3D stress analysis.

Learning Outcome &Suggested Student Activities:
After completion of this unit students are able to derive element matrices for applying the principles to find stresses in beams and trusses and temperature distribution in composite walls and fins. In addition to text books, the following URLs will be highly useful to the students to develop and solve FEM models using beam and truss elements.
http://www.youtube.com/watch?v=UeatU9OpDNA&list=PLA4CBD0C55B9C3878
http://uqu.edu.sa/files2/tiny_mce/plugins/filemanager/files/4041296/ComputerApplicationsInStructures/LeturesTutorialsDowloadedFromWeb/Lecture%202%20Truss%20and%20Beam%20FEM.pdf
http://www.engineering.uiowa.edu/~sxiao/class/058-153/lecture-24.pdf
www.rpi.edu/~des/CST.ppt

UNIT V
HEAT TRANSFER AND FLUID MECHANICS PROBLEMS:
Steady state heat conduction with convective and heat flux boundary conditions, Functional approach, Galerkin approach formulation of element characteristic matrices and vectors in 1D and 2D problems. Temperature distribution in composite walls one dimensional and two dimensional fins and extended surfaces.
Two dimensional potential flow problems: Potential function formulation and stream function formulation.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to solve bars, trusses, beams and heat transfer problems using FEM and also to apply boundary conditions in realistic problems. In addition to text books, the following URLs will be highly useful to the students to develop and solve FEM models using different elements. The students are also advised to use FEM software to solve all application problems.
http://www.mecheng.iisc.ernet.in/~suresh/me237/fea/Chapter6.pdf
http://www.colorado.edu/engineering/cas/courses.d/IFEM.d/IFEM.Ch22.d/IFEM.Ch22.pdf

Text Books:

1. *Introduction to Finite Element in Engineering, TirupatiChandrapatla and Bellagundu , Pearson Education, New Delhi.*
2. *Finite Element Methods, S. S. Rao , Pergamom Press, New York*

Reference Books:

1. *Introduction to FEM, J. N. Reddy, TMH Publishers, New Delhi.*
2. *Finite Element Analysis, C.S. Krishna Moorthy, TMH Publishers, New Delhi.*
3. *Fundamentals of Finite Element Analysis, David V. Hutton , TMH Publishers, New Delhi.*
4. *Finite Element Analysis, G.Lakshmi Narasaiah, BS Publication.*
5. *A Primer on Finet Element Analysis, Anand V.Kulkarni, Venkatesh K. Havanur, University Science Press, 2014*
6. *Finite Element Analysis- Proceedures in Engineering, H.V.Lakshminarayana, Universities Press,2013.*

WEB REFERENCES

1. *Finite Element Method IIT Kanpur Course, Prof. C.S. Upadhyay http://nptel.iitm.ac.in/video.php?subjectId=112104115*
2. *Computational Methods in Design and Manufacturing by Dr. R. Krishnakumar, Department of Mechanical Engineering, IIT Madras http://nptel.iitm.ac.in/video.php?subjectId=112106135*

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(13A03704) METROLOGY AND MEASUREMENTS

Course objective:
Students will be able to understand the Limits and Fits, linear measurements and angular measurements, gauges, comparators, optical measuring methods, measurement of flatness and roughness of surface. And also learn about the screw thread and gear measuring methods, Alignment tests on machine tools.
Students will be able to understand various transducers to measure displacement like Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers and also learn about Calibration procedure, temperature and pressure calibration methods, the measurement of flow stress, strain measurements acceleration and vibration.

UNIT I

LIMITS, FITS and TOLERNCES : Introduction, Definitions, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard system – International Standard organization system for plain work.
LIMIT GAUGES and GAUGE DESIGN: Plug, Ring, Snap, Gap, Taper gauges. Taylor's principle. Design of Go and No Go gauges.
COMPARATORS: Principle of Measurement with Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the Limits, Fits and Tolerance. Indian standard system – International Standard organization system. He will know the principles of working of the most commonly used instruments for measuring linear and angular distances.
http://www.nptel.iitm.ac.in
http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv113-Page1.htm

UNIT II

LINEAR MEASUREMENT: Length standard, line and end & wavelength standards, slip gauges – calibration of the slip gauges, Dial indicator, micrometers, vernier height gauges.
MEASUREMENT OF ANGLES AND TAPERS: Different methods – Bevel protractor – angle gauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.
FLATNESS MEASUREMENT: Measurement of flatness of surfaces – straight edges– surface plates – optical flat and auto collimators, interferometer and their uses.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to study the different types of Comparators, optical measuring instruments, flatness measurement methods and measuring methods of surface roughness. http://www.nptel.iitm.ac.in/and for notes, http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv113-Page1.htm

UNIT III

SURFACE ROUGHNESS MEASUREMENT: Differences between surface roughness and surfacewaviness- Numerical assessment of surface finish – CLA, R.M.S Values – R_a , R_z values, Methods of measurement of surface finish-profilograph, Talysurf, BIS symbols for indication of surface finish.
SCREW THREAD MEASUREMENT: Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch- profile thread gauges.

GEAR MEASUREMENT: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness.
MACHINE TOOL ALIGNMENT TESTS: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling and drilling machine tools. Preparation of acceptance charts.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand, Screw thread elements and measuring methods, Gear tooth profile measurement, CMM, Alignment tests on lathe, milling and drilling machine tools.

UNIT IV

MEASUREMENT OF DISPLACEMENT: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.
MEASUREMENT OF SPEED: Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer .
STRESS & STRAIN MEASUREMENTS: Various types - electrical strain gauge - gauge factor - method of usage of resistance strain gauge for bending, compressive and tensile strains - usage for measuring torque, Strain gauge Rosettes.
MEASUREMENT OF ACCELERATION AND VIBRATION: Different simple instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand working of various instruments used for measuring for displacement, temperature and pressure.

UNIT V

MEASURMENT OF TEMPERATURE: Standards and calibration, thermal expansion methods, thermo electric sensors(thermocouples), Electrical Resistance sensors, Junction semiconductor sensors, Digital thermometers, Radiation methods.
MEASUREMENT OF PRESSURE AND SOUND: Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers, Elastic transducers, vibrating cylinder, resonant transducers, High and low pressure measurement, sound measurement.
MEASUREMENT OF FORCE, TORQUE,POWER: Standards and calibration, Basic methods of Force Measurement, Torque measurement on rotating shafts, shaft power measurement(dynamometers), Vibrating wire force transducers.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand working of various instruments used for measuring for flow, speed,stress,strain and Vibration.

Text Books:

(1) *Mechanical Measurements ,Beckwith, Marangoni, Linehard, PHI, PE*
(2) *Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh, TMH,2012.*
(3) *Engineering Metrology, R.K. Jain, Khanna Publishers, 20th edition, 2013.*

Reference Books:

(1) *Engineering Metrology, Mahajan, DhanpatRai, 2nd edition, 2013.*
(2) *BIS standards on Limits & Fits*
(3) *Fundamentals of Dimensional Metrology,Connie Dotson ,4e, Thomson*
(4) *Metrology & Measurement by Anand K Bewoor, vinay A kulkarni, Mc GrawHill, 2013.*
(5) *Instrumentation, measurement &analysis ,B.C.Nakra&KKChoudhary, TMH, 6th edition, 2011.*

Web References:

http://emtool box.nist.gov

CambridgeViscosity.com/Viscometer
www.e.FlukeCal.com/Calibration
www.inscotemperature.com/
www.solartronmetrology.com/

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(13A03705) AUTOMOBILE ENGINEERING
(CBCC II)

Course Objective:

The students acquires sufficient knowledge to classify Engines, Chassis, Fuel Supply Systems, Cooling Methods, Lubrication Methods, Ignition Systems, Generating Systems, Suspension Systems, transmission system, steering mechanism and braking methods.

The students get the working knowledge of assembly of various components of layout and of various electrical equipment of an automobile.

UNIT I

Introduction: Components of a Four Wheeler Automobile – Chassis and Body – Power Unit –Power Transmission – Rear Wheel Drive, Front Wheel Drive, Four Wheel Drive – Types of Automobile Engines, Engine Construction, Turbo Charging and Super Charging – Oil Filters, Oil Pumps – Crank Case Ventilation.

Learning outcome & Suggested Student Activities:

Student can understand the function of each and every component of an automobile. Student can understand the use of turbo charging and super charging. Students may refer the following website auto.howstuffworks.com, www.em.gov.au for better understanding of this topic.

UNIT II

Emissions from Automobiles – Pollution Standards National and International – Pollution Control– Techniques – Multipoint Fuel Injection for SI Engines- Common Rail Diesel Injection, Emissions from Alternative Energy Sources– Hydrogen, Biomass, Alcohols, LPG, CNG - Their Merits And Demerits.

Electrical System: Charging Circuit, Generator, Current – Voltage Regulator – Starting System, Bendix Drive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge – Oil Pressure Gauge, Engine Température Indicator.

Learning outcome & Suggested Activities:

Student can be able to grasp the knowledge on emission standards, emission control techniques and electrical systems. Student can identify thrust areas for carrying their dissertation in future. Students may refer the following website www.dec.ny.gov,www.studymode.com,www.ehow.com, www.automotiveservices.blogspot.com for better understanding of this topic.

UNIT III

Transmission System: Clutches- Principle- Types: Cone Clutch, Single Plate Clutch, Multi Plate Clutch, Magnetic and Centrifugal Clutches, Fluid Fly Wheel – Gear Box- Types: Sliding Mesh, Constant Mesh, Synchromesh, Epi-Cyclic, Over Drive, Torque Converter.

Propeller Shaft – Hotch – Kiss Drive, Torque Tube Drive, Universal Joint, Differential, Rear Axles.

Learning outcome &Suggested Student Activities:

At the end of the unit, student can have broad knowledge on each and every component of transmission system of a automobile. Students may refer the following websites en-wikipedia.org/wiki/transmission, www.youtube.com, www.youtube.com, jalopink.com, www.geansandstuff.com for better understanding of this topic.

UNIT IV

Steering System: Steering Geometry – Camber, Castor, King Pin Rake, Combined Angle Toe-In, Center Point Steering. Types Of Steering Mechanism – Ackerman Steering Mechanism, Davis Steering Mechanism, Steering Gears – Types, Steering Linkages.

Learning outcome & Suggested Student Activities:

After the completion of the chapter, student can able to understand purpose and methods of steering systems and their applications. Students may refer the following website www.scribd.com, www.youtube.com,leemyles.com

www.howcanworks.com, www.forza.se/sider/of/listton/bi/stein1.pdf for better understanding of this topic.

UNIT V

Suspension System: Objects of Suspension Systems – Rigid Axle Suspension System, Torsion Bar, Shock Absorber, Independent Suspension System.

Braking System: Mechanical Brake System, Hydraulic Brake System, Pneumatic and Vacuum Brake Systems.

Learning outcome & Suggested Student Activities:

At the end of the unit. Student can have ample knowledge on suspension system and braking system of an automobile.

Students may refer the following website www.youtube.com, www.howcanworks.com, www.forza.se/sider/of/listton/bi/stein1.pdf for better understanding of this topic.

Text Books:

1. *Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers Distributors, 13th edition, 2013.*
2. *Automobile Engineering , William Crouse, TMH, 10th edition, 2006.*

Reference Books:

1. *Automobile Engineering ,R.K.Rajput,Laxmi Pub, 1st edition, 2013.*
2. *Automobile Engineering ,K.K.Ramalingam/Scitech Pub, 2nd edition.*
3. *Automotive engines , Newton, Steeds & Garret.*

Books in Digital Libraray:

www.nptel.iitm.ac.in

Suggestions:

Student is requested to visit the research and development cell of Automobile manufacturing companies and A.R.A.I emission testing centers.

For better understanding of these systems students may visit the Automobile service centre and APSRTC workshop.

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(13A03706) TOOL DESIGN
(CBCC II)

Course Objective:
To make the students to understand the design of single point cutting tool.
To learn about the design of drilling tool, tool wear Machinability index and tool life.
To make the students to understand jigs and fixtures, design principle of jigs and fixtures, locating and clamping principles.
To learn about the sheet metal operations, Design forming ,drawings ,Bending and drawing dies, forming dies.
To make the students to understand plastics commonly used as tooling material.

UNIT I

Tool materials: Ferrous, non ferrous, materials, heat treatment, plastics Classification of moulds used in processing of plastics, Design of injection, blow, and compression moulds.

Learning outcome &Suggested Student Activities:
After completion of this unit, students are able to understand the fundamentals of plastics as tooling materials, processing of plastics for tooling materials, heat treatment of materials, ferrous, nonferrous, non metallic, tooling materials.

UNIT II

Design of single point cutting tools: Single point, cutting tools-various systems of specifications, geometry and their interrelation, theories of formation of chip and their effect.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand single point cutting tool geometry and its design theory of chip formation.

UNIT III

Design of multipoint cutting tools: Drill geometry, Design of Drills, Rake & Relief angles of twist drill, speed, feed and depth of cut, machining time, forces, milling cutters, cutting speeds and feed-machining times-design-form cutters, combination tools, reamers etc.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the drilling tool geometry and its design. Tool life, machinability and tool wear.

UNIT IV

Design of jigs and fixtures: Basic principles of location and clamping, locating, methods and devices, jigs, definitions, types, general consideration in the design of jigs, drills bushing, methods of construction, fixtures-vice fixtures milling, boring, and lathe grinding fixtures.

Learning outcome &Suggested Student Activities:
After completion of this unit students are able to understand the design of Jigs and fixtures and advantages and disadvantages of Jigs and fixtures, types of Jigs & Fixtures – Principles of location and clamping. Some examples of jigs and fixtures.

UNIT V

Design of sheet metal blanking and piercing: Fundamentals of die cutting operating, power press-types, General press information, Material handling equipment, cutting action in punch and die

operation. Die clearance, and types of Die construction. Die design fundamentals-blanking and piercing die construction, pilots, striper and pressure pads presswork material, strip layout.
Design of sheet metal bending, forming and drawings die: Bending dies, drawing dies, forming dies, drawing operations, variables that effect metal flow during drawing. Determination of blank size, drawing force, single and double action draw dies.

Learning outcome &Suggested Student Activities:
After completion of this unit students are able to understand the press working operations like punching, blanking, bending, drawing and forming, types of power presses, design of die, strip layout

Text Books:

1. Tool Design, Donaldson, Lecain and Goold, Tata McGraw Hill, 4th edition, 2012.
2. Principles of Metal cutting, A Bhattacharya, New Central Book Agency, Calcutta
3. ASTME Hand book on Tool Design.

Reference Books:

1. Production Engineering Design (Tool Design) , SurendraKenav and Umesh 'Chandra, Satyaprakashan, New Delhi 1994..
2. Design of cutting Tools. Use of Metal Cutting Theory. ASTME publication Michigan USA, 1969.Amitabha Battacharya

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(13A03707) TRIBOLOGY
(CBCC II)

Course Objective:
Students should be able to understand the effect and importance of friction between different surfaces and should know to calculate the friction.
Students must be able to know the phenomenon of wear between surfaces in contact and its implications.
Students should be able to understand the principles, methods, purpose and selection of lubricants for the reduction of friction.
Students should be able to understand the lubrication theory and the flow of lubricants with different applications.
Students should know the surface treatment methods to improve the wear resistance and friction properties. Material selection for different types of bearings could be understand

UNIT I

SURFACES AND FRICTION: Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction - Adhesion Ploughint- Energy dissipation mechanisms Friction Characteristics of metals - Friction of non metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction - Source of Rolling Friction - Stick slip motion - Measurement of Friction.

Learning Outcome & Suggested Student Activities:
Students can understand the characteristics of engineering surfaces, sources of friction, friction characteristics of metals and non metals and friction measurements. The following URLs are highly useful for better understanding. For the topic rolling friction go through the website http://www.phy.davidson.edu/fachome/dmb/PY430/Friction/rolling.html. For friction related topics go through the link http://nptel.iitm.ac.in/courses/112102015/5 and http://nptel.iitm.ac.in/courses/112102014/3

UNIT II

WEAR: Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals - Abrasive wear - Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture wear - Wear of Ceramics and Polymers - Wear Measurements.

Learning Outcome & Suggested Student Activities:
Students can understand the wear and wear mechanisms, situations causing wear and methods to reduce and also know the materials for a particular wear situation. Students are advised to visit materials lab in the college for understand the properties and also visit following URLs http://www.substech.com/dokuwiki/doku.php?id=mechanisms_of_wear http://www.substech.com/dokuwiki/doku.php?id=tribology_of_ceramics&s=film%20lubrication%20theory http://nptel.iitm.ac.in/courses/112102015/11 and http://nptel.iitm.ac.in/courses/112102014/6

UNIT III

LUBRICANTS AND LUBRICATION TYPES: Types, properties, Requirements of Lubricants - Testing methods - Hydrodynamic Lubrication - Elasto hydrodynamic lubrication- Boundary Lubrication, Mist lubrication, Requirements of lubrication, Solid Lubrication, Hydrostatic Lubrication.

Learning Outcome & Suggested Student Activities:
Students can understand the properties of different lubricants used for various applications, testing

methods of lubrications and types of lubrications.Students are able to identify the lubrication modes such as hydrodynamic lubrication, elasto-hydrodynamic lubrication, formulate elasto-hydrodynamic lubrication models for line and point contacts. Students are advised to visit automobile workshop/various labs in the college and to know how the lubricants are using for different applications. The following URLs are useful for better understanding
http://www.substech.com/dokuwiki/doku.php?id=classification_of_lubricants&s=types%20properties%20lubricants
http://nptel.iitm.ac.in/courses/112102015/17 and http://nptel.iitm.ac.in/courses/112102014/11

UNIT IV

FILM LUBRICATION THEORY: Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque on the bearings - Virtual Co-efficient of friction - The Somerfield diagram.

Learning Outcome &Suggested Student Activities:
Students can able to understand the theory of film lubrication, principles of bearing selection, reaction torque on the bearings, virtual co-efficient of friction, somerfield diagram and bearing arrangement in machines. The students are advised to observe the working of journal bearing in any workshops/ machine labs an also visit following URLs http://nptel.iitm.ac.in/courses/112102015/24 and http://nptel.iitm.ac.in/courses/112102014/19
http://rotorlab.tamu.edu/me626/Notes_pdf/Modern%20Lub%20Notes%2001-15.pdf.

UNIT V

SURFACE ENGINEERING AND MATERIALS FOR BEARINGS: Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes - Surface coatings - Plating and anodizing - Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

Learning Outcome &Suggested Student Activities:
Students can understand how the surface treatment methods are useful to improve the wear resistance and friction properties for the mating surfaces and also know the selection of bearing materials for different types of bearings. Students are advised to visit bearings manufacturing industry to understand design concepts, materials and also visit following URLs
http://www.substech.com/dokuwiki/doku.php?id=engine_bearing_materials&s=materials%20bearings
http://nptel.iitm.ac.in/courses/112102015/28 and http://nptel.iitm.ac.in/courses/112102014/27.

Text Books:

1. I.M. Hutchings, Tribology, " Friction and Wear of Engineering Material ", Edward Arnold, London, 1992.

Reference Books:

1. T.A. Stolarski, " Tribology in Machine Design ", Industrial Press Inc., 1990.
2. Kenneth C Ludema, Friction, Wear, Lubrication: A textbook in Tribology, CRC Press,1996.
3. A.Cameron, " Basic Lubrication theory ", Longman, U.K.., 1981.
4. M.J.Neale (Editor), " Tribology Handbook ", Newnes. Butter worth, Heinemann, U.K., 1975.
5. B.C. Majumdar "Introduction to Tribology bearings", S. Chand

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(13A03708) COMPUTATIONAL FLUID DYNAMICS (CBCC III)

Course Objective:
This course covers topics related to Computational Fluid Dynamics (CFD). CFD is an important tool in engineering analysis and design of fluid systems. In this course Students will develop the equations describing fluid flow and numerical solutions to these equations. Emphasis will be placed on understanding different approaches employed for both time and spatial discretization and how to evaluate these approaches. Students will look at time accurate and steady-state methods, explicit and implicit techniques, laminar and turbulent flow, compressible and incompressible approaches, stability considerations, etc. These techniques will be applied to applications of mixing and heat transfer.

UNIT I

INTRODUCTION: Methods to solve a physical problem , numerical methods , brief comparison between FDM, FEM & FVM, applied numerical methods. Solution of a system of simultaneous linear algebraic equations, Iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for baned matrices. Finite difference applications in heat conduction and convention, heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer.

Learning outcome &Suggested Student Activities:
This chapter gives the overall view of the various kinds of numerical methods adopted. It also discusses about various solutions for the numerical methods adopted in CFD. The applications of finite difference methods with examples in conduction and convective heat transfer are introduced.

UNIT II

FINITE DIFFERENCES: Discretization, consistency, stability, and fundamentals of fluid flow modeling. Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

Learning outcome &Suggested Student Activities:
This chapter gives how to descretize partial differential equations, including the governing flow equations which is the foundation for the finite difference method. Explicit and implicit approaches represent the fundamental distinction between various numerical techniques.

UNIT III

ERRORS AND STABILITY ANALYSIS: introduction, first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

REVIEW OF EQUATIONS GOVERNING FLUID FLOW AND HEAT TRANSFER: Introduction, Conservation of mass Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier stokes equations.

Learning outcome &Suggested Student Activities:
This chapter focuses on numerical errors that are generated and how the numerical calculations become unstable and also entails the conservations of mass, momentum and energy equations to the fluid flow along with Navier stokes equation.

UNIT IV

STEADY FLOW: Dimensions form of momentum and energy equations, navier stokes equation, and conservative body force fields, stream function, vorticity formulation, boundary, layer theory, buoyancy, driven convection and stability.

Learning outcome &Suggested Student Activities:
This unit gives the fundamental principles of fluid mechanics, its governing differential equations and boundary conditions.

UNIT V

SIMPLE CFD TECHNIQUES: Viscous flows conservation form space marching, relovation techniques, viscous flows, conservation from space marching relovation techniques, artificial viscosity, the alternating direction implicit techniques, pressure correction technique, computer graphic techniques used in CFD. Quasi one dimensional flow through a nozzle, turbulence models, standard and high reynolds number models and their applications.

Learning outcome & Suggested Student Activities:
This unit gives the information about some techniques for numerical solutions for flow problems. These equations are applicable to time and space marching solutions especially parabolic hyperbolic and elliptic equations.

Text Books:

1. *Computational Fluid Dynamics, J Chung (2010), 2nd edition, Cambridge University Press, India.*
2. *Computational Fluid Dynamics, John .D. Anderson (2010), 3rd edition, McGraw- Hill International Edition, India.*

Reference Books:

1. *Computational Fluid Mechannics and Heat Transfer, Ronnie Anderson, 3rd edition, CRC Press, Special Indian Edition.*
2. *Computational aerodynamics and fluid dynamics an introduction, Jean-Jacques Chattot (2010),3rd edition, Springer, Germany.*
3. *Essential computational fluid Dynamics – olegzikanov, wiley India.*
4. *Introduction to computational fluid dynamics – pradip, Niyogi S.K. Chakrabary, M.K. Laha – pearson.*

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(13A03709) CONCURRENT ENGINEERING
(CBCC III)

Course Objective:
Student has to understand the concept and need for sequential engineering or Concurrent engineering and it's benefit for the modern industry.
Student has to understand the co-operation/ coordination required between the different departments like marketing, design and the latest softwares available sofar
The student has to know the different procedures to be followed during the design, modifications, and optimization techniques for the Design for Manufacture (DFM).
The student has to understand the importance of quality of the product and know the methods of evaluating the quality.
The student must be able to assess the reliability & economics of the Design for Manufacture (DFM) being done/ learned.

UNIT I

INTRODUCTION: Sequential engineering process, Concurrent engineering definition and requirement, meaning of concurrent objectives of CE, benefits of CE, Life cycle design of products, life cycle costs.

SUPPORT FOR CE: Classes of support for CE activity, CE organizational, structure CE, team composition and duties, Computer based Support, CE Implementation Process.

Learning Outcome & Suggested Student Activities:
Students can understand the meaning, objectives and benefits of the concurrent engineering, life-cycle design of the products, structure and organisation and implementation process of the CE.
Students are advised to refer text book mikell P. Groover for CE definition & advantages and for solid modeling, Besterfield on quality control for it supports and also visit URLs www.perfectlogic.com/articles/AI/ExpertSystems/ExpertSystems.html.

UNIT II

DESIGN PRODUCT FOR CUSTOMER: Industrial Design, Quality Function Deployment, house of quality, Translation process of quality function deployment (QFD). Modeling of Concurrent engineering design- Compatibility approach, Compatibility index, implementation of the Compatibility model, integrating the compatibility Concerns

Learning Outcome & Suggested Student Activities:
Student can understand the design of the product as per the customer requirements and also understand the co-operation/ coordination required between the different departments like marketing, design and the latest softwares available so far.
Students are advised to visit industries like IFB, ITW for better understanding of the concept.

UNIT III

DESIGN FOR MANUFACTURE (DFM): Introduction, role of DFM in CE, DFM methods, e.g. value engineering, DFM guidelines, design for assembly, creative design methods, product family themes, design axioms, Taguchi design methods, Computer based approach to DFM. Evaluation of manufacturability and assembliability.

Learning Outcome & Suggested Student Activities:
Students can understand the role of design for manufacturing in concurrent engineering, different

DFM methods, creative design methods and computer based approach to DFM.
Student can be explained the procedures being followed by companies such as KPIT Cummins-Pune and made to visit the same which is nearby.

UNIT IV

QUALITY BY DESIGN: Quality engineering & methodology for robust product design, parameter and Tolerance design, Quality loss function and signal to noise ratio for designing the quality, experimental approach.

Learning Outcome & Suggested Student Activities:
Students can understand the importance of quality during the product design and methods used to evaluate the quality.
Student can be given a small component for Design for Manufacture (DFM) in consultation with industries

UNIT V

DESIGN FOR X-ABILITY: Design for reliability, life cycle serviceability design, design for maintainability, design for economics, decomposition in concurrent design, concurrent design case studies.

Learning Outcome & Suggested Student Activities:
Students can understand the design of the product for reliability, maintainability and economics. Students are advised to visit the following URLs www.lumbs.lu.se/database/alumini/03-04/theses/jeganova-julija.pdf for lifecycle design of products and also visit www.rug/nl/staff/e.w.berghout/nijlandberghout_flcmgt.pdf for life cycle semi realization.

Text Books:

1. Concurrent Engineering- Kusiak - John Wiley & Sons
2. Concurrent Engineering- Menon - Chapman & Hall

Reference Books:

1.Integrated Product Development/Anderson MM and Hein, L.Berlin, Springer Verlog,1987.
2.Design for Concurrent Engineering/ Cleetus, J. Concurrent Engg. Research Centre,Morgantown,WV, 1992.

Student can be directed to industries who uses the Concurrent Engineering concepts.

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(13A03710) PRODUCTION AND OPERATIONS MANAGEMENT
(CBCC III)

Course Objective:
To make the students understand the functions of production planning & controls, generating of new products, issues in product design and strategies of aggregate planning.
To provide the knowledge on principles of forecasting, forecasting methods, types and its accuracy.
To provide the knowledge on facilities location, various types layouts and assembly line balancing.
To provide the knowledge on lean management, concepts of JIT, six sigma, quality control, MRP,ERP and LOB.
To make the students understand the inventory management and scheduling techniques.

UNIT I

Functions of Production Planning & Controls operations & productivity, productivity measurement, Design of goods and services: selection, generating new products, product development, issues in product design.

Strategies for aggregates planning, aggregate planning using O.R. Models, Chase planning, Expediting, controlling aspects.

Learning Outcome & Suggested Student Activities:
At the end of this unit students can get the concepts on Production planning & controls operations and its functions, productivity and productivity measurements, design of goods and services and aggregate planning. Students are advised to visit following URLs http://www.nptel.iitm.ac.in/courses/IIT-MADRAS/Management_Science_II/Pdf/3_5.pdf. And also well documented note is available in pdf form at the following links.
www.processprotocol.com/extranet/doucuments/pdf/.../production1.pdf
elearning.dbhosting.net/.../Production%20Planning%20And%20Control
http://www.academicearth.org/lectures/product-development-process-observation

UNIT II

Forecasting – Importance of forecasting – Types of forecasting, their uses – General Principles of forecasting – Forecasting techniques – qualitative methods and quantitive methods – accuracy of forecasting methods.

Learning Outcome & Suggested Student Activities:
Students can understand the importance of forecasting, uses of long term and short term forecasting and application of qualitative and quantitative methods for finding the future demands. Students are advised to refer the text book Forecasting: Methods and Applications Spyros G. Makridakis, Steven C. Wheelwright , Rob J Hyndman. For video lectures advised to visit following URLs http://www.learnerstv.com/video/Free-video-Lecture-2496-Management.htm;
http://www.slideshare.net/jrdn_27/qualitative-and-quantitative-methods-of-research

UNIT III

Factors affecting facilities location, mathematical models for facilities, location, Types of facilities-layout: product layout, process layout, group technology layout, Assembly line balancing, computerized layout: ALDEP, CRAFT, CORELAP.

Learning Outcome & Suggested Student Activities:
At the end of the unit the student will be able to understand where the plant is to be located based on facilities available and what are the important factors affecting the facilities location of a plant, and plant layout. And also able to understand plant layout design to facilitate material flow and processing of a product in the most efficient manner through the shortest possible time. Can compare the rural & urban sites, methods of selection. The following URLs are useful to the students
http://www.slideshare.net/satya4/plant-layout-16143741
http://freevideolectures.com/Course/2371/Project-and-Production-Management/32
http://www.tcyonline.com/video-tutorials-computerised-layout-planning/101568

UNIT IV

Lean Management, philosophy and creation of lean enterprise, JIT concepts-Kanban System-Elements of total quality management, Six Sigma Quality Control.
MRP, –lot sizing techniques in MRP, introduction to ERP, LOB (Line of Balance).

Learning Outcome & Suggested Student Activities:
Students can understand the how philosophy of lean management applied to develop lean enterprise and basic concepts JIT, Six sigma control etc., Students are advised to visit the following URLs .http://www.learnerstv.com/video/Free-video-Lecture-6944-Management.htm;
http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-852j-integrating-the-lean-enterprise-fall-2005/lecture-notes/
http://freevideolectures.com/Course/2688/Human-Resource-Management/13

UNIT V

Scheduling Policies – Techniques, flow shop and job shop Scheduling techniques.
Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems-(S, s) Policy.

Learning Outcome & Suggested Student Activities:
At the end of the unit the student will be able to understand the scheduling policies, flow shop and job shop scheduling techniques and concepts of Inventory, Classification, Functions, it's associated costs etc., and also able to recognize the importance of Inventory control to ensure their availability with minimum capital lock up. The following URLs are useful to the students.
http://www.technologyevaluation.com/search/for/inventory-management-pdf.html
http://freevideolectures.com/Course/3096/Operations-and-Supply-Chain-Management/10

Text Books:

1. Production and Operations Management, Ajay K. Garg, McGrawHill,2015
2. Operation Management by B. Mahadevan, PearsonEdu.
3. Operation and O.M by Adam & Ebert- PHI Pub.,

Reference Books:

1. Operations Management – S.N. Chary.
2. Inventory Control Theory and Practice , Martin K. Starr and David W. Miller.
3. Production Control A Quantitative Approach , John E. Biegel.
4. Operations Management , Joseph Monks.
5. Operation Management by Jay Heizar& Read new Pearson

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech. IV-I Sem. (M.E)	**L**	**C**
	3	**2**

(13A03711) METROLOGY AND MEASUREMENTS LABORATORY

Any 6 experiments from each section

Section A:

1. Measurement of bores by internal micrometers and dial bore indicators.
2. Use of gear teeth vernier calipers and checking the chordal addendum and chordal height of spur gear.
3. Alignment test on the lathe and milling machine
4. Study of Tool makers microscope and its application
5. Angle and taper measurements by Bevel protractor, Sine bars, spirit level etc.
6. Thread measurement by Two wire/ Three wire method.
7. Surface roughness measurement by Talysurf instrument.
8. Use of straight edge and sprit level in finding the flatness of surface plate.

Section B:

1. Calibration of Pressure Gauges
2. Calibration of transducer or thermocouple for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Study and calibration of capacitive transducer for angular measurement.
5. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
6. Study and calibration of a rotometer for flow measurement.
7. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
8. Study and calibration of Mcleod gauge for low pressure.

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3 **2**

(13A03712) COMPUTER AIDED ENGINEERING LABORATORY

I. Introduction to Analysis Software Package

II. Structural Analysis:(Any Four exercises)

Analysis of a rectangular plate with a hole

1. Analysis of a truss member under loading
2. Analysis of a bracket plate with axial loading
3. Analysis of a bracket plate with eccentric loading
4. Static Analysis of Prismatic bar
5. Static Analysis of a Corner Bracket
6. Static Analysis of beam
7. Analysis of Thermally Loaded support Structure
8. Analysis of Hinged support member
9. Analysis of Tapered plate under transverse load

III. Thermal Analysis:(Any two exercises)

1. Analysis of a square plate considering conduction
2. Analysis of a square plate considering conduction and convection
3. Analysis of a compound bodies considering conduction and convection

IV. CAM (Any Six exercises)

1. Introduction to CNC & NC Machines
2. Introduction to CNC & NC part programming – for Different operations like Turning, Threading, Milling, Drilling etc., (G-Codes & M-Codes)
3. Experiments on CNC lathe -Turning, Threading operations
4. Experiments on Milling Machine - Plane Milling, Drilling Operations
5. Experiment on Robot – pick up an object with & without using teach window
6. Developing a CNC code for a given job using
   i) Solid works- CAM
   ii) PRO-E- CAM
   iii) MASTER CAM
   iv) Edge CAM

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B.Tech. IV-II Sem. (M.E)	**Th**	**Tu**	**C**
	3	**1**	**3**

(13A03801) INDUSTRIAL ENGINEERING

(MOOC I)

Course Objective:
To make the students understand the concepts of Industry Practices, to able to identify the requirements for establishing a plant, to understand the production process and work metrics and to understand the types of inventories and managing the inventory for better profitability and also to understand the management concepts.

UNIT I

Concepts of Management-Administration and Organization – Functions of Management – Schools of

Management Thought: Taylor's Scientific Management, Fayol's Principles of Management, Douglas

Mc-Gregor's Theory X and Y, Mayo's Hawthorne Experiments, Hertzberg's Two factor Theory of

Motivation, Maslow's Hierarchy of Human needs – Systems Approach to Management.

Organizational Structures- Functional- Divisional- Matrix etc., Basic Concepts Related to Organization – Departmentation and Decentralization and their Merits, Demerits and Suitability

UNIT II

Plant Location: Definition, Factors affecting the Plant Location, Comparison of Rural and Urban sites,

Selection of Plant Location – Types of Production; Plant Layout: Definition, Objectives, Types of Plant Layout - Materials Handling: Functions- Objectives – Types, Selection Criteria of Material Handling Equipment.

UNIT III

Work Study – Definition, Objectives, Method Study – Steps Involved – Various Types of Process Charts –Micro motion and Memo motion Studies.

Work Measurement - Definition, Time Study, Steps involved - Equipment, Different Methods of

Performance Rating - Allowances, Standard Time Calculation. Work Sampling - Definition, Steps

Involved, Standard Time Calculations - Applications.

UNIT IV

Inventory Models- Deterministic models- EOQ Models – With and Without Shortages Models; Inventory Models with Price Breaks -Probabilistic Models –Discrete Variable, Continuous Variable. Inventory Control Systems

UNIT V

Inspection & Quality Control: Statistical Quality Control- Techniques-Variables and Attributes- Control Charts: X and R Charts; P Charts and C Charts. Acceptance Sampling Plan - Single Sampling and Double Sampling Plans- OC Curves. Introduction to TQM-Quality circles-BIS & ISO Standards-Importance .

Text Books:

1. Manufacturing Organization and Management, T.Amrine/ Pearson, 2nd Edition, 2004
2. Industrial Engineering and Management ,O.P.Khanna, DhanpatiRai, 18th edition, 2013.
3. Industrial Engineering and Management, Dr. C.Nadamuni Reddy, New Age International

Publishers, 1st edition, 2011.

Reference Books:

1. Industrial Engineering and production management, MartindTelsang S.Chand.2015

2. Industrial Organisation and Engineering Economics, T.R.Banga, S.C.Sharma, Khanna,2015

3. Management by James AF Stoner, Freeman 6th Ed, Pearson Education, New Delhi,2015

4. Production and Operations management, PanneerSelvam, PHI,2004.

5. Statistical Quality Control by EL Grantt, McGrawhil, 2014

6. Motion and time studies by Ralph M Barnes, John Wiley and Sons,2004

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	3	**1**	**3**

(13A03802) ENTREPRENEURSHIP

(MOOC I)

Course Objective:
To make the students understand the concepts of entrepreneurship. To understand type os idea generation to start an enterprise, To understand the concepts of ventures, business plans, marketing plans, sources of capital, New venture setup and expansion strategies and sales and promotional aspects of a product etc.,

UNIT 1: Introduction to Entrepreneurship Definition Types of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision process. Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad.

Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creative problem solving, product planning and development process.

UNIT II: The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities.

UNIT III: Financing and Managing the new venture, Sources of capital, venture capital , angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. E-commerce and Entrepreneurship, Internet advertising.

UNIT IV: New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits.Choosing location and layout, Issues related to Selection of layout.

UNIT V: Production and Marketing Management Thrust of production management, Selection of production Techniques, plant utilization and maintenance, Designing the work place, Inventory control, material handling and quality control.Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing. Global aspects of Enterprenership.

Text Books:

1Entrepreneurship, Robert Hisrich, & Michael Peters, TMH, 5th Edition

2. Entrepreneurship, Dollinger, Pearson, 4/e 2004.

REFERENCES:

1. Dynamics of Entrepreneurial Development and management, Vasant Desai, Himalaya Publishing House, 2004.

2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.

3. Entrepreneurial Management, . Robert J.Calvin:, TMH, 2004.

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B.Tech. IV-II Sem. (M.E)	**Th**	**Tu**	**C**
	3	**1**	**3**

(15A03803) COMPOSITE MATERIALS

(MOOC I)

Course Objective:
To make the students aware of various composite materials available, the structure of composites, to learn about manufacturing methods, to analyze the macro mechanical stress and strain, micromechanical analysis of Lamina, To understand the failure analysis of material

Introduction to Composite Materials: Introduction, Classification: Polymer Matrix Composites. Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber. Reinforced Composites and nature-made composites, and applications

Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide. fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosets, Metal matrix and ceramic composites.

Unit-II

Manufacturing methods: Autoclave curing, tape production, moulding methods, filament winding, hand layup, pultrusion, RTM. Compression moulding, tape winding.

Macromechanical Analysis of a Lamina: Introduction ,Definitions: Stress, Strain ,Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

Unit-III

Micromechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi Empirical Models ,Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion

UNIT-IV

Macromechanical Analysis of Laminates: Introduction, Laminate Code, Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus of a Laminate , Hygrothermal Effects in a Laminate, Warpage of Laminates

UNIT-V

Failure Analysis and Design of Laminates: Introduction, Special Cases of Laminates, Failure Criterion for a Laminate.

Text Books:

1. Engineering Mechanics of Composite Materials- Isaac and M Daniel, Oxford University Press, 1994.
2. Mechanics of Composite Materials, R. M. Jones, Mc Graw Hill Company, New York, 1975.

References:

1. Analysis and performance of fibre Composites, B. D. Agarwal and L. J. Broutman Wiley- Interscience, New York, 1980.
2. Mechanics of Composite Materials, Second Edition (Mechanical Engineering)- Autar K. Kaw, Publisher: CRC
3. Finite Element Analysis of Composite Materials, Ever J. Barbero , CRC Press, 2007.
4. Analysis of Laminated Composite Structures, L. R. Calcote, Van Nostrand Rainfold, New York, 1969.
5. Mechanics of Composite Materials and Structures, Madhujit Mukhopadhyay, University Press, 2009.
6. Composite Materials Science and Engineering, Krishan K. Chawla, Springer, 2009

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	3	**1**	**3**

(13A03804) POWER PLANT ENGINEERING

(MOOC II)

Course Objective:
To make the students understand the importance of energy and constructional features and procedure of various types of power plants.

UNIT I

Introduction To The Sources Of Energy – Resources and Development of Power in India.

Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power

Cycles - Comparison and Selection,

Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges,

Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve.

Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor,

Diversity Factor – Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment –

Pollutants and Pollution Standards – Methods of Pollution Control. Inspection And Safety Regulations.

UNIT II

Steam Power Plant : Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

Steam Power Plant : Combustion Process : Properties of Coal – Overfeed and Under Feed Fuel Beds,

Traveling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its

Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO2 Recorders

UNIT III

Diesel Power Plant: Diesel Power Plant: Introduction – IC Engines, Types, Construction– Plant Layout with Auxiliaries – Fuel Storage

Gas Turbine Plant : Introduction – Classification - Construction – Layout With Auxiliaries – Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

UNIT IV

Hydro Electric Power Plant: Water Power – Hydrological Cycle / Flow Measurement – Drainage Area Characteristics – Hydrographs – Storage and Pondage – Classification of Dams and Spill Ways.

Hydro Projects and Plant: Classification – Typical Layouts – Plant Auxiliaries – Plant Operation Pumped Storage Plants. .

UNIT V

Power from Non-Conventional Sources: Utilization of Solar Collectors- Principle Of

its Working, Wind Energy – Types of Turbines – HAWT & VAWT-Tidal Energy. MHD power

Generation.

Nuclear Power Station: Nuclear Fuel – Nuclear Fission, Chain Reaction, Breeding and Fertile Materials – Nuclear Reactor –Reactor Operation.

Types of Reactors: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast

breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding –

Radioactive Waste Disposal.

Text Books:

1. Power plant Engineering, P.K. Nag, TMH, 3rd edition, 2013.

2. A course in power plant Engineering, Arora and S. Domkundwar.

Reference Books:

1. A Text Book of Power Plant Engineering , Rajput , Laxmi Publications, 4th edition, 2012.

2. Power plant Engineering, Ramalingam, Scietech Publishers

3. power plant engineering P.C. Sharma, S.K. Kataria Publications,2012.

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	3	**1**	**3**

(13A03805) GAS TURBINES AND JET PROPULSION

(MOOC II)

Course Objective:
To make the students understand the working principles of Gas Turbines and concepts of Jet Propulsions.

UNIT-I

Gas Turbine Operating Cycles: Simple open cycle gas turbine or air standard Brayton cycle, Actual Brayton cycle, the cycle air flow rate, the cycle work ratio, optimum pressure ratio or maximum cycle thermal efficiency, means of improving the efficiency and the specific out put of simple cycle.

UNIT-II

Gas Turbines; gas turbine applications, gas turbine advantages & disadvantages, energy flow & back work, deviation from ideal cycle, gas turbine with regeneration, thermal efficiency of gas turbine with & without regenerator, gas turbine engines, inter- cooling & reheating, turbojet engine, turbofan engine, turboprop engine.

UNIT-III

Jet propulsion: Historical sketch- reaction principle- essential features of propulsion devices- Thermal jet engines, classification of – energy flow, thrust, thrust power and propulsion efficiency- need for thermal jet engines and applications.

Turboprop and turbojet – thermodynamic cycles, plant layout, essential components, and principles of operation – performance evaluation – thrust augmentation and Thrust reversal – contrasting with piston engine propeller plant.

UNIT-IV

Ram jet- Thermo dynamic cycle, plant lay out, essential components – principle of operation – performance evaluation – comparison among atmospheric thermal jet engines- serqujet and pulse jet, elementary treatment.

Rocket Engines: Need for, applications- basic principle of operation and parameters of performance – classification, solid and liquid propellant rocket engines, advantages, domains of application – propellants – comparison of propulsion systems.

UNIT-V

Rocket Technology: Flight mechanics, application thrust profiles, acceleration- staging of rockets, need for – feed systems, injectors and expansion nozzles – rocket transfer and ablative cooling.

Testing & instrumentation - need for Cryogenics – advanced propulsion systems, elementary treatment of Electrical nuclear and plasma Arc Propulsion.

TEXT BOOKS:

1. Gas Turbines , V. Ganesan TMGH
2. Gas turbines , cohen , Rogers & Sarvana Muttoo , Addision Wiley & longman

REFERENCES BOOK:

1. Thermodynamics of propulsion, Hill & Paterson.
2. Rocket Propulsion , Sutton.
3. Element of Gas Turbines propulsion , Jack D Matingly, MGH

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	3	**1**	**3**

(13A03806) ENERGY MANAGEMENT

(MOOC II)

Course Objective:
To make the students understand managerial economics of energy projects, to study about decpreciation and cost analysis and methods of investment analysis. To understand the energy auditing concepts.

UNIT - I

ENGINEERING ECONOMICS:

Managerial objectives - steps in planning- Capital budgeting- Classification of costs- Interest- Types- Nominal and effective interest rates Discrete and continuous compounding - discounting - Time value of money - Cash flow diagrams - Present worth factor, Capital recovery factor, Equal annual payments - Equivalence between cash flows.

UNIT - II

DEPRECIATION & COST ANALYSIS:

Aims-Physical depreciation-Functional depreciation- Methods of depreciation-Straight line method, Declining balance method, Sum of years digits method, Sinking fund method, Service output method- Capital recovery with return-Service life estimation- Morality curves. Break even analysis and break even chart- Minimum cost analysis- Benefit cost analysis- Life cycle cost analysis.

UNIT - III

PROJECT MANAGEMENT:

Methods of investment appraisal- Rate of return method, Payback period method, Net present value method (NPV)- Internal Rate of Return method(IRR)- Adoption of the methods in energy conservation campaign- Types of projects- Purpose of project management - Classification – Role and qualities of project manager - Types of budgets - Budget committee – budgeting.

ENERGY MANAGEMENT PROGRAMS:

Necessary steps of energy management programmer - Concepts of Energy management - General principles of energy management – Energy management in manufacturing and process industries- Qualities and functions of Energy manager - Language of Energy manager-Checklist for top management.

UNIT - IV

ENERGY AUDITING:

A definition- Objectives- Level of responsibility- Control of Energy- Uses of Energy checklists - Energy conservation- Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- Questionnaire - Energy audit of industries - General energy audit- Detailed energy audit - Energy saving potential.

UNIT - V

ENERGY POLICY, SUPPLY, TRADE& PRICES:

Energy resources in India – level of power generation – transmission & distribution of power. Indian energy policy,Energy trade & its economic impacts – domestic energy production – Energy transformation & distribution & energy self sufficiency. International & National crude oil prices – domestic fuel prices – natural gas, LPG, kerosene and firewood - pricing policy.

BOOKS:

1. Albert Thumann, Handbook of Energy Audits, The Fairmont Press Inc., Atlanta gergia, 1979.
2. Murphy W.R and Mckay G, Energy Management, Butterworths, London, 1982.
3. Albert Thumann, Plant Engineer and Management guide to Energy Conservation, Van Nost and Reinhold Co., Newyork.
4. Energy Audits, E.E.O.-Book-lets, U.K. 1988.
5. Craig B.Smith, “Energy Management Principles”, Pergamon Press.
6. The role of Energy Manager, E.E.O., U.K.
7. The Energy conservation Design Resource Hand Book-The Royal architectural Institute of Canada.
8. Energy Management Hand Book-Ed. By Wayne C. Turner, John Wiley and sons, 1982.

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	3	**1**	**3**

(13A03807) MODERN MANUFACTURING METHODS

(MOOC III)

UNIT I

Need for Modern Manufacturing Methods: Non-traditional machining methods and rapid prototyping

methods - their relevance for precision and lean manufacturing.

Classification of non-traditional processes - their selection for processing of different materials and the range of applications.

Introduction to rapid prototyping - Classification of rapid prototyping methods - sterolithography, fused deposition methods - materials, principle of prototyping and various applications.

UNIT II

Ultrasonic machining – Elements of the process, mechanics of material removal, process parameters,

applications and limitations.

Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal,

descriptive of equipment, process variables, applications and limitations.

UNIT III

Electro – Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM.

Chemical Machining: Fundamentals of chemical machining- Principle of material removal- maskants – etchants- process variables, advantages and applications.

UNIT IV

Thermal Metal Removal Processes: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for improved surface finish and machining accuracy -

Applications of different processes and their limitations.

Plasma Machining: Principle of material removal, description of process and equipment, process

variables, scope of applications and the process limitations.

UNIT V

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron

beam machining, comparison of thermal and non-thermal processes - process mechanics, parameters,

applications and limitations.

Laser Beam Machining: Process description, Mechanism of material removal, process parameters,

capabilities and limitations, features of machining, applications and limitations.

Text Books:

1. Advanced machining processes, VK Jain, Allied publishers.

2. Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R Schmid,

5edn, Pearson Pub.

Reference Books:

1. New Technology , Bhattacharya A, The Institution of Engineers, India 1984

2. Manufacturing Technology, Kalpakzian,Pearson

3. *Modern Machining Process , Pandey P.C. and Shah H.S., TMH.*

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	3	**1**	**3**

(13A03808) RAPID PROTOTYPING

(MOOC III)

Unit-I Introduction: Need for the compression in product development, History of RP system,

Survey of applications, Growth of RP industry and classification of RP system.

Stereo Lithography System: Principle, Process parameter, Process details, Data

preparation, Data files and machine details, Applications.

Unit II Fusion Decomposition Modeling: Principle, process parameter, Path generation, Applications. **Solid ground curing:** Principle of operation, Machine details, Applications, **Laminated Object Manufacturing**: Principle of Operation, LOM materials, Process details, Applications.

Unit –IIIConcepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer, GenisysXs printer HP system 5, Object Quadra system.

Unit –IV LASER ENGINEERING NET SHAPING (LENS)

Rapid Tooling: Indirect Rapid tooling- Silicon rubber tooling- Aluminum filled epoxy tooling

Spray metal tooling, Cast kriksite, 3Q keltool, etc, Direct Rapid Tooling Direct. AIM, Quick cast

process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft, Tooling vs. hard tooling.

Software for RP: STL files, Overview of Solid view, magics, imics, magic communication, etc.

Internet based software, Collaboration tools.

Unit V Rapid Manufacturing Process Optimization: Factors influencing accuracy, Data

preparation error, Part building error, Error in finishing, Influence of build orientation.

Allied Process: Vacuum casting, surface digitizing, Surface generation from point cloud, Surface modification- Data transfer to solid models.

TEXT BOOKS:

1. " stereo lithography and other RP & M Technologies**"**, Paul F.Jacobs, SME, NY 1996

2. " Rapid Manufacturing **",** Flham D.T &Dinjoy S.S, Verlog London 2001

"Rapid automated**"**, Lament wood, Indus Press New York.

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	3	**1**	**3**

(13A03809) PRODUCT DESIGN

(MOOC III)

Course Objective:
To make the students understand the product development process, requirements setting, conception design,, embodiment design principles, to understand the basics of mechatronics and adaptronics.

UNIT I

PRODUCT DEVELOPMENT PROCESS

General problem solving process - Flow of Work during the process of designing - Activity Planning Timing and scheduling, Planning Project and Product Costs - Effective Organization Structures - Interdisciplinary Cooperation, Leadership and Team behavior.

UNIT II

TASK CLARIFICATION

Importance of Task Clarification - Setting up a requirements list - Contents, Format, Identifying the requirements, refining and Extending the requirements, Compiling the requirements list, Examples.

Using requirements lists - Updating, Partial requirements lists, Further uses - Practical applications of requirements lists.

UNIT III

CONCEPTUAL DESIGN

Steps in Conceptual Design.

Abstracting to identify the essential problems - Aim of Abstraction, Broadening the problem. Formulation, Identifying the essential problems from the requirements list, Establishing functions structures, Overall function, Breaking a function down into sub-functions.

Developing working structures - Searching for working principles, Combining Working Principles, Selecting Working Structures, Practical Application of working structures.

Developing Concepts - Firming up into principle solution variants, Evaluating principle solution variants, Practical Applications of working structures.

Examples of Conceptual Design - One Handed Household Water Mixing Tap, Impulse - Loading Test Rig.

UNIT IV

EMBODIMENT DESIGN - Steps of Embodiment Design, Checklist for Embodiment Design Basic rules of Embodiment Design

Principles of Embodiment Design - Principles of Force Transformations, Principles of Division of Tasks, Principles of Self-Help, Principles of Stability and Bi-Stability, Principles of Fault-Free Design

Guide for Embodiment Design - General Considerations, Design to allow for expansion, Design to allow for creep and relaxation, Design against Corrosion, Design to minimize wear, Design to Ergonomics, Design for Aesthetics, Design for Production, Design for Assembly, Design for Maintenance, Design for Recycling, Design for Minimum risk, Design to standards.

Evaluation of Embodiment Designs.

UNIT V

MECHANICAL CONNECTIONS, MECHATRONICS AND ADAPTRONICS

Mechanical Connections - General functions and General Behavior, Material connections, From Connections, Force connections, Applications.

Mechatronics - General Architecture and Terminology, Goals and Limitations, Development of Mechatronic Solution, Examples.

Adaptronics - Fundamentals and Terminology, Goals and Limitations, Development of Adaptronics Solutions, Examples.

Text Books:

1. Engineering Design: G.Paul; W. Beitzetal, Springer International Education 2010.

2. Product Design And Developement: Kevin Otto: K. Wood Pearson Education 2016.

Reference Books:

1. Product Planning Essentials: Kenith B. Kahu, Yes dee Publishing 2011.

2. Product Design and Development: K.T. Ulrich TMH Publishers 2011.