

Course Name: MATHEMATICS II

Course Code: MA102 Credits :4 LTP :3 1 0

Pre Req : MA101

Lecture wise breakup

No. of Lectures

1. ALGEBRA (20)

Vector spaces $R^n(R)$, Linear dependence, Basis, Dimension, Co-ordinates with respect to a basis, Change of basis, Subspace., Linear transformation $R^n \rightarrow R^m$, Range space and Rank, Null space and Nullity, Rank and Nullity relation, Matrix representation of a linear transformation, Similar matrices, Invertible linear transformation., Inner product, Norm, Gram-Schmidt orthogonalization process, Eigenvalues and eigenvectors, Cayley Hamilton theorem., Properties of eigenvalues and eigenvectors of Symmetric, Skew-symmetric, Orthogonal, Hermitian, Skew – Hermitian, Unitary and Normal matrices, Bounds on eigenvalues, Diagonalization of a matrix.

2. DIFFERENTIAL EQUATIONS (19)

First order exact differential equations, Integrating factor, Orthogonal trajectories, Existence and uniqueness of solutions, Applications to Science and Engineering., Higher order linear differential equations with constant coefficients, Methods of variation of parameters and undetermined coefficients., Equations reducible to linear equations with constant coefficients, Existence and uniqueness of solution of initial value problem, Wronskian. Simultaneous linear equations with constant coefficients, Applications including modeling of physical systems. Second order differential equations with variable coefficients, Total differential equations, Simultaneous total differential equations with applications.

3.LAPLACE TRANSFORM (6)

Laplace transform, Inverse transform, properties, Transforms of derivatives and integrals, Unit step function, Dirac's delta function, Differentiation and integration of transforms, Applications to differential equations.

TEXT BOOK:

1. Advanced Engineering Mathematics, Kreyszig, John Wiley and Sons.

REFERENCE BOOKS:

1. Linear Algebra, Hoffman and Kunze, Prentice Hall.
2. Introduction Linear Algebra with Applications, Kolman, Pearson Education
3. Differential Equations, Frank Ayers, TMH

MA 102H, MATHEMATICS II honours

In addition to the contents of MA 102 the additional topics:

REFERENCES:

1. Rajaraman V., "Fundamentals of Computers", PHI.
2. Sanders, D.H., "Computers Today", McGraw Hill.
3. Balaguruswamy B, "Programming in C" McGraw Hill Publication.
4. Byron Gottfried , "Programming with C", McGraw Hill
5. Kernighan & Ritchie, " The C Language Programming", Pearson

Course Name : ENGINEERING GRAPHICS
Course Code : TAN 102 Credits : 4 L T P : 2 0 4

Pre Req:**Lecturer wise breakup****No. of lectures**

1. Introduction to Engineering Graphics. System of Projections. Technical lettering, scales, Orthographic Projections. 3 - views. Projection of oblique areas. Circular features. **(06)**
2. Reading of orthographic Views, Meaning of lines and areas. Pictorial sketching. Missing views and missing lines, Dimensioning, rules of dimensioning. **(06)**
3. General Introduction to isometric Projections. **(06)**
4. Projection of Points, Lines and Planes, Geometrical Constructions. Elements of descriptive geometry. True length, True shape, minimum distance, true angles.
5. Projection of Solids, Sectioning, intersection of Solids. **(06)**
6. Auxiliary, Planes and views. **(06)**
7. Development of Surfaces. **(06)**
8. Introduction to AutoCAD, Practice of Simple Drawings on AutoCAD **(06)**

BOOKS:

1. Engineering Drawing by P.S. Gill
2. Engineering Drawing by N.D. Bhatt
3. Engineering Graphics with Autocad by James D. Bethune, Pearson Education

REFERENCES:

- 1 Fundamentals of Engineering Drawing by Luzadder and Duff, PHI.

Course Name : INTRODUCTION TO ENGINEERING DESIGN
Course Code : TAN 103 Credits : 4 L T P : 3 0 2

Pr-req. : ----

Lecture wise breakup**No. of Lectures**

1. **ENERGY CONVERSION PROCESSES (10)**
 Thermodynamic work, p-dv work in various processes, p-V representation of various thermodynamic processes and cycle, Properties of pure substance, Statements of I and II laws of thermodynamics and their applications in Mechanical Engineering. Carnot cycle for Heat engine, Refrigerator and Heat pump.

Statement and explanation of Fourier's law of heat conduction, Newton's law of cooling, Stefan Boltzmann's law, Conducting and insulating materials and their properties. Selection of heat sink and heat source.

2. ENERGY CONVERSION DEVICES (09)

(Theoretical study using schematic diagrams only)

Package Boiler, Turbine Impulse & Reaction turbine (Steam Gas Turbines).

Working principle and applications of Reciprocating I.C. engines, Air motor, Reciprocating pumps (single acting & double acting), reciprocating compressor, rotary compressors, fans, blowers, Study of household refrigerator, window air conditioner, split air conditioner Ratings and selection criteria of above devices. Refrigerants and their impact on environment.

POWER PLANTS (Description with Block Diagrams)

Thermal, Hydroelectric, Nuclear and Solar-Wind Hybrid Power Plants.

3. FLUID MECHANICS (08)

Introduction to Fluids & Flows: Fluid Properties; type of flow; stream line, path line, and streak line. Introduction to flow measurement Pitot tube, Venturimeter, Orifice meter & Notches & Weirs (Rectangular & Triangular) Rotameter. Brief Introduction & classification of turbine & pumps.

4. MATERIALS USED IN ENGINEERING AND THEIR APPLICATIONS (04)

Metals – ferrous and Non-Ferrous, Nonmetallic materials, Material selection criteria.

5. Design Principles (05)

The design process; nature of design process; iteration and decision making / morphology, need identification and analysis; the specifications problem; divergence; convergence; detailing, testing, Standardisation and modularity, Design for manufacturing assembly, use, maintenance, safety, Reliability and robustness

Term work shall consist of record of any seven experiments and creative design project as per the following:

1. Study of water cooler, domestic refrigerator (conventional & frost free).
2. Study of window & split a.c.
3. Study of two stroke engine (petrol & diesel).
4. Study of four stroke engine (petrol & diesel).
5. Study of Cochran Boiler.
6. Flow measurement using. (a) Pitot tube
(b) Venturimeter
7. Experimental verificational effect of insulating material on heat transfer.
8. Fabricating designed project using appropriate material to show creativity of design and implementing principles of design.

BOOKS

1. P.K. Nag, Thermodynamics, Tata McGraw – Hill publishing co. Ltd.
2. Hajra-Chaudhari, Workshop Technology.
3. Fluid Mechanics by D.S. Kumar.

REFERENCE BOOKS

1. Yunus A. Cengel and Boles, Thermodynamics, Tata McGraw – Hill Publishing Co. Ltd.
2. Arora and Domkunwar, Dhanpat Rai and Sons.
3. R.K. Rajput, Heat Transfer, S. Chand Publication, Delhi.
4. V.B. Bhandari, Design of Machine Elements, Tata McGraw-Hill Publishing Co. Ltd.

Course Name: MECHATRONICS

COURSE NO: TAN 104 CREDIT: 5 LTP: 3 1 3

Pre Req:

Lecture wise break up

No of Lectures

1.INTRODUCTION TO MECHTRONICS

Mechatronics Case Study, Introduction to Mechatronics Engineering Laboratory. (03)

2.REVIEW OF BASIC ELECTRONICS

Ohm's Law, Semi conductors (PN Junction Diode, AC Rectification, Zener Diode),Power Supplies (03)

3.PRINCIPLE AND APPLICATIONS OF TRANSISTORS AND OPERATIONAL AMPLIFIERS

Transistor (Common Emitter Characteristics, Emitter Follower Circuit, FET), Thyristor ,Triac Operational Amplifiers, (Inverting, Unity Gain, Non-inverting, current –to-voltage (C/V) and voltage –to –current (V/C) Amplifiers, Differential Amplifier, (Instrumentation Amplifier) (03)

4.DIGITAL ELECTRONICS

Boolean Algebra, Digital Electronics Gates, Combinational Logic System (Simple Gates, NAND,NOR, Latches, Positive and Negative Logic, Tri-state Logic) Sequential Logic Systems (J-K flip-flop ,registers and Counters, Timers and Pulse Circuits (06)

5.SENSORS AND TRANSDUCER PRINCIPLES AND APPLICATIONS

Introduction to Sensors and Transducers; General Transducer Characteristics (Static and Dynamic performance Characteristics), Calibration, Signal Conditioning, Sensor and Transducer Applications, Measurement of :Angular Position, Linear Displacement, Rotational Speed, Force, Pressure, Strain ,Flow Rate, Temperature (08)

6.DRIVE TECHNOLOGY :PRINCIPLE AND APPLICATION

Physical Principle, Solenoid-type devices, DC Machines, A C Machines, Stepper Motors Drive Technology Applications

Linear Motors, Voice Coil Motors, Electro-pneumatic and Electro-hydraulic Actuators (06)

7.ELECTRO MECHANICAL SYSTEM PRINCIPLE AND APPLICATIONS

Rotary to Linear Motion Conversion, Power Transmission ,Electromechanical System Applications, Coupling, gearing, Belts, Pulleys, Bearings

8. A/D, D/A CONVERSION :BASIC PRINCIPLE (02)

9. INTRODUCTION TO PLC

PLC Hardware, plc Memory Structure , Basic Applications (05)

10 MICROPROCESSOR AND MICROCONTROLLER BASIC OPERATION AND APPLICATIONS (04)

TEXT BOOK:

MECHATRONICS By W. Bolton ;Pearson Education

REFERENCE BOOKS:

1. Dan Necsulescu Mechatronics published by Pearson Education (Singapore) Pvt. Ltd. Indian Branch, 482 FIE, Patparganj, Delhi India.
2. Book by H M T Limited, Mechatronic Tata McGraw Hill Publishing Company Ltd. New Delhi.
3. Mechatronic Principles, Concepts & Applications by Nitaigour P Mahalik published by TMH.

Course Name : INTRODUCTION TO MANUFACTURING

Course Code : TAN 105

Credits : 4

L T P : 2 0 4

Pre-Req. : ----

Lecture wise breakup

No of Lectures

MANUFACTURING MATERIALS AND THEIR MANUFACTURING PROPERTIES (03)

Plastic Deformation of Materials, Cold Warm & Hot working of metals.

CONCEPT OF MANUFACTURING (05)

Examples of Manufacturing Products, Selecting Materials and Manufacturing Processes, Global Competitiveness and Manufacturing Costs

METAL CASTING PROCESSES & EQUIPMENT (05)

Fundamental of Metal Casting, Principles of Various Metal Casting Processes and Their Applications

FORMING & SHAPING PROCESSES AND EQUIPMENT (04)

Rolling, Forging, Extrusion & Drawing of Metals, Sheet Metal Working

MATERIAL REMOVAL PROCESSES AND MACHINES (04)

Fundamentals of Cutting, Cutting Tool Materials and Cutting Fluids, Machining Processes Used For Producing Round Shapes, Flat Surfaces and Other Shapes
Abrasive Machining & Finishing Operations, Advanced Machining

JOINING PROCESS AND EQUIPMENT (04)

Weld-ability of Metals, Principles and Applications of Various Welding Processes.
Brazing, Soldering, Adhesive Bonding

SURFACE TREATMENT (03)

Principles and Applications of various types of Surface Treatments

WORKSHOP EXERCISES

CARPENTRY AND PATTERN MAKING (06)

Exercises including the use of important carpentry tools to practice various operations and making joints

FOUNDRY SHOP (06)

Preparation of small sand moulds and castings, firing a furnace

FORGING PRACTICE	(06)
Simple smithy, forging exercises	
MACHINE SHOP	(06)
Exercise involving machining on a machine tool(s)	
WELDING SHOP	(06)
Exercises involving use of gas/ electric arc welding	
ELECTRICAL AND ELECTRONICS SHOP	(06)
Preparation of PCBs, Soldering applied to electrical and electronic applications	
FITTING SHOP	(06)
An exercise on fitting involving use of different fitting tools	
SHEET METAL SHOP	(06)
Exercise involving use of sheet metal forming operations for small jobs	
ELECTROPLATING SHOP	(06)
Exercise involving electroplating operations	
AUTOMOBILE SHOP	(06)
Exercises involving use of automotive tools and automobile operations	

TEXT BOOKS:

1. Manufacturing Engineering. & Technology by Kalpakjian & Schmid – Pearson Education Asia 2002 Edition

REFERENCES:

1. Materials & Processes in Manufacturing by Degarmo, Black & Kohser – Prentice Hall India
2. Manufacturing Technology by P. N. Rao - Tata McGraw Hill
3. Fundamentals of Metal Cutting & Machine Tools by Juneja & Sekhon – Wiley Eastern Ltd.

COURSE NAME: ENVIRONMENTAL STUDIES
COURSE CODE: TAN-106
L T P: 4 0 0 CREDITS 4

Unit-1: The Multidisciplinary nature of Environmental Studies : Definition, Scope and Importance ,

Need for public awareness. (4)

Unit- 2: 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 their effects on forests 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 problem, changes caused by agriculture and overgrazing, effects of modern agriculture,

fertilizer-pesticide problems, water logging, salinity, case studies ; Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies; Land resources: Land as resource ,land degradation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources ;Equitable use of resources for sustainable lifestyles. (8)

Unit-3: Ecosystems : Concept of an ecosystem ,Structure and friction of an ecosystem ,Producers , consumers and decomposers ,Energy flow in the ecosystem ,Ecological Succession ,Food chains, food webs and ecological pyramids ,Introduction , types , characteristic features, structure and function of the following ecosystem ;Forest ecosystem, Grassland ecosystem ,Desert ecosystem , Aquatic ecosystem (ponds, stream, lakes, rivers, oceans, estuaries) (8)

Unit-4: Biodiversity and Its Conservation :Introduction-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-spots of biodiversity, Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts, Conservation of biodiversity : In-situ Ex-situ conservation of biodiversity. (8)

Unit -5: Environmental Pollution : Definition, ,Causes, effects and control measures of ; Air pollution, Water pollution, Soil pollution, Marine Pollution, Noise Pollution , Thermal Pollution ,Nuclear Hazards; Solid waste Management: Causes, effects and control measures of urban and industrial wastes ;Role of an individual in prevention of pollution ,Pollution case studies ,Disaster management: floods, earthquake, cyclone and landslides. (8)

Unit -6: 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. (8)

Unit-7: Human Population and the Environment: Population growth variation among nations, Population explosion- Family Welfare Programme , Environmental and human, health, Human Rights ,Value Education, HIV /AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health ,Case Studies. (8)

Unit-8: Field Work : Visit to local area to document environmental assets-river/grassland/hill/mountain, Visit to a local polluted site-Urban/Rural/Industrial/Agricultural , Study of common plants, insects, birds ,Study of simple ecosystems- pond, river, hill slopes etc.(Field work Equal to 5 lecture hours) (8)

Suggested Text books:

1. Deswal S & Deswal A, Basic Course in Environmental Studies, Dhanpat Rai & Company Ltd., New Delhi.

Selected References:-

1. Agarwal, K C 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. De A.K. Environmental Chemistry, Wiley Eastern Ltd.
3. Heywood, V.H.& Watson, R.T.1995. Global Biodiversity Assessment Cambridge Univ. Press.
4. Odum, E.P.1971. Fundamentals of Ecology. W.B. Saunders Co. USA.
5. Rao M.N. & Datta, A.K.1987. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd.
6. Sharma B.K.,2001. Environmental Chemistry , Goel Publ. House, Meerut.

Course Name : UNIFIED ELECTRICAL ENGINEERING
Course Code: ENN-101 **Credits:** 4 **LTP:** 4 0 0

Pre Req.

Lecture wise breakup

No. of Lectures

- 1. CIRCUIT LAWS & THEOREMS (08)**
Kirchoff's laws, mesh & nodal analysis, Superposition, Thevenin's, Norton's and maximum power transfer theorems, application of theorems in AC & DC circuits.
- 2. STEADY STATE ANALYSIS OF A.C.CIRCUITS (08)**
Sinusoidal and phasor representations, single phase A.C. circuits-behavior of resistance, inductance and capacitance and their combinations in series & parallel, power factor, series & parallel resonance, bandwidth and quality factor, magnetic circuits, three phase A.C. circuits
- 3. TRANSFORMER (04)**
Principle, construction, operation, determination of equivalent circuit, voltage regulation, efficiency, all-day efficiency, parallel operation.
- 4. D.C. MACHINES (06)**
Construction, types, EMF and torque equations, characteristics of DC generators and motors, speed control of DC motors, DC motor starters, brushless DC machines.
- 5. A.C. MACHINES (10)**
Construction & working of transformer, equivalent circuit, voltage regulation and its efficiency. The revolving magnetic field, principle of operation of three phase induction motor, equivalent circuit, torque-speed characteristics, starters for cage & wound rotor type induction motors, applications. Principle of operation and applications of synchronous motor. Principle of operation of single phase induction motors, types and applications.
- 6. SEMICONDUCTOR DEVICES (08)**
Semiconductor materials-introduction, classification of semiconductor, conductivity of semiconductor, theory of PN junction diode, and its V-I characteristics, breakdown in PN junction diode, special purpose diodes like zener diode, tunnel Diode, LED. Half wave ,

full wave & bridge rectifiers, filters & its types, ripple factor. Construction, transistor biasing, operation of NPN and PNP transistors, its configuration, transistor as an amplifier.

7. BASIC MEASURING INSTRUMENTS (04)

Introduction Classification of instruments operating principles essential features of measuring instruments, moving coil permanent magnet instruments ,moving iron instruments , electro-dynamometer instruments. Introduction to OPAM and its basic operations.

BOOKS:

1. Principles of Electrical Engineering, V. Deltoro, PHI
2. Albert D. Helfrick and William D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, New Delhi, 1994.
3. Integrated Electronics, Millman & Halkias, TMH

Course Code: PY 101 Credits: 4 L T P: 3 1 0

Pre-requisite: None

Lecture-wise breakup (No. of Lectures)

1. OPTICS

Interference: Division of wave front and amplitude; Fresnel's biprism, Newton's rings, Michelson interferometer and its applications for determination of λ and $d\lambda$. (4)

Diffraction: Fresnel and Fraunhofer diffraction, half period zones, zone plate, diffraction at a straight edge, plane transmission grating, dispersive power & resolving power of a grating. (5)

Polarization: Quarter wave and half wave plates, production and analysis of plane, circular and elliptically polarized light, optical activity and specific rotation, Biquartz and Laurent's half shade polarimeters. (4)

Lasers: Introduction to Lasers, pumping, population inversion, Einstein coefficients, three and four level lasers, Properties of Laser beams, Ruby, He-Ne, CO₂ and semiconductor lasers, Applications (5)

Optical fibres: Basic principles, fibre construction, light propagation in fibres, signal distortion, transmission losses, light wave communication and other applications. (4)

2. SPECIAL THEORY OF RELATIVITY

Inertial and non-inertial frames of reference, Galilean transformation, Michelson Morley Experiment, postulates of special theory of relativity, Lorentz transformation, Simultaneity, Length contraction, Time dilation, Doppler effect, Addition of velocities, variation of mass with velocity, mass-energy relation, four vectors, space-time continuum. **(9)**

3. EM THEORY

Gradient, Divergence and Curl – Physical meaning and mathematical expressions in Cartesian coordinate system, Divergence theorem & Stokes' theorem, Continuity equation, Review of basic concepts of electrodynamics before Maxwell, Maxwell's Modification of Ampere's law, Displacement-current, Maxwell's equations, Boundary conditions, Poynting's theorem & Poynting vector. **(6)**

EM wave equation and its simple plane wave solutions in non-conducting and conducting media, skin depth. **(4)**

TEXT BOOKS:

1. **Fundamentals of Physics** : Halliday, Resnick, Walker.
2. **Optics:** Optics, by Ajoy K Ghatak (Tata McGraw-Hill)
3. **EM Theory & Relativity:** Introduction to Electrodynamics, by D.J. Griffiths (Pearson)

REFERENCE BOOKS:

1. Fundamentals of Optics, by Jenkins & White (McGraw-Hill)
2. A Text Book of Engineering Physics, by Avadhanulu & Kshirsagar (S. Chand)
3. Lasers & Non-linear Optics, by B.B. Laud (New Age International)
4. Concepts of Modern Physics, by Arthur Beiser (McGraw-Hill)