SYLLABUS OF PHYSICS FOR CIVIL ENGINEERING

BSC	PHYSICS (MECHANICS)	L:3	T:1	P:3	Credit:5.5

CIVIL ENGINEERING

INTRODUCTION TO MECHANICS

DETAIL CONTENT

PRE-REQUISITION: HIGH- SCHOOL EDUCATION

MODULE 1 : (08 LECTURES)

TRANSFORMATION OF SCALARS AND VECTORS UNDER ROTATION TRANSFORMATION; FORCES IN NATURE; NEWTON'S LAWS AND ITS COMPLETENESS IN DESCRIBING PARTICLE MOTION; FORM INVARIANCE OF NEWTON'S SECOND LAW; SOLVING NEWTON'S EQUATIONS OF MOTION IN POLAR COORDINATES; PROBLEMS INCLUDING CONSTRAINTS AND FRICTION; EXTENSION TO CYLINDRICAL AND SPHERICAL COORDINATES.

MODULE 2 : (07 LECTURES)

POTENTIAL ENERGY FUNCTION; F = - GRAD V, EQUIPOTENTIAL SURFACES AND MEANING OF GRADIENT; CONSERVATIVE AND NON-CONSERVATIVE FORCES, CURL OF A FORCE FIELD; CENTRAL FORCES; CONSERVATION OF ANGULAR MOMENTUM; ENERGY EQUATION AND ENERGY DIAGRAMS; ELLIPTICAL, PARABOLOIC AND HYPERBOLIOC ORBITS; KEPLER PROBLEM; APPLICATION: STELLITE MANOEUVRES.

MODULE 3 : (05 LECTURES)

NON-INERTIAL FRAMES OF REFERENCE. ROTATING COORDINATE SYSTEM: FIVE-TERM ACCELERATION FORMULA. CENTRIPETAL AND CORIOLIS ACCELERATIONS; APPLICATIONS: WEATHER SYSTEMS, FOUCAULT PENDULUM.

MODULE 4 : (06 LECTURES)

HARMONIC OSCILLATOR; DAMPED HARMONIC MOTION – OVER–DAMPED, CRITICALLY DAMPED AND LIGHTLY-DAMPED OSCILLATORS; FORCED OSCILLATIONS AND RESONANCE.

MODULE 5 :(05 LECTURES)

DEFINITION AND MOTION OF A RIGID BODY IN THE PLANE. ROTATION IN THE PLANE; KINEMATICS IN A COORDINATE SYSTEM ROTATING AND TRANSLATING IN THE PLANE; ANGULAR MOMENTUM ABOUT A POINT OF A RIGID BODY IN PLANAR MOTION. EULER LAW'S OF MOTION THEIR INDEPENDENCE FROM NEWTON'S LAWS, AND THEIR NECESSITY IN DESCRIBING RIGID BODY MOTION; EXAMPLES.

MODULE 6 : (07 LECTURES)

INTRODUCTION TO THREE-DIMENSIONAL RIGID BODY MOTION -- (A) ANGULAR VELOCITY VECTOR, AND ITS RATE OF CHANGE AND (B) MOMENT OF INERTIA TENSOR; THREE-DIMENSIONAL MOTION OF A RIGID BODY WHEREIN ALL POINT MOVE IN A COPLANAR MANNER: e.g. ROD EXECUTING CONICAL MOTION WITH CENTER OF MASS FIXED --ONLY NEED TO SHOW THAT THIS MOTION LOOKS TWO-DIMENSIONAL BUT IS THREE-DIMENSIONAL AND TWO –DIMENSIONSAL FORMULATION FAILS.

SUGGESTED REFERENCE BOOKS:

- ENGINEERING MECHANICS, 2^{ND} ED. – MK HARBOLA
- INTRODUCTION TO MECHANICS – MK VERMA
- AN INTRODUCTION TO MECHANICS – D KLEPPNER & KOLENKOW
- PRINCIPLES OF MECHANICS – JL SYNGE & BA GRIFFITHS
- MECHANICS – JP DEN HARTOG
- ENGINEERING MECHANICS – DYNAMICS, 7^{TH} ED. – JL MERIAM
- MECHANICAL VIBRATION – JP DEN HARTOG.
- THEORY OF VIBRATION WITH APPLICATIONS – WT THOMSON.

List of Experiments:

1. Measurements of length (or diameter) using vernier caliper, screw gauge, and travelling microscope.

2. To determine the Height of an object using a Sextant.

3. To determine the Moment of Inertia of a Flywheel.

4. To verify that fundamental frequency of vibration of a steel bar clamped at one end is inversely proportional to the square of its length and measure the Young's modulus of bar.

5. To determine g by Bar Pendulum.

6. To determine g and velocity for a freely falling body using Digital Timing Technique.

7. To compare the moment of inertia of a solid sphere and hollow sphere or solid disc of same mass with the torsional pendulum.

SYLLABUS OF PHYSICS FOR COMPUTER SCIENCE ENGINEERING (CSE) AND INFORMATION TECHNOLOGY (IT)

BSC	PHYSICS (SEMICONDUCTOR PHYSICS AND INTRODUCTION TO QUANTUM MECHANICS)	L:3	T:1	P:3	Credit:5.5

PREREQUISTE: SEMICONDUCTOR PHYSICS

DETAIL CONTENT

MODULE 1 : SEMICONDUCTORS (08 LECTURES)

INTRINSIC AND EXTRINSIC SEMICONDUCTORS, DEPENDENCE OF FERMI LEVEL ON CARRIER-CONCENTRATION AND TEMPERATURE (EQUILIBRIUM CARRIER STATISTICS), CARRIER GENERATION AND RECOMBINATION, CARRIER TRANSPORT: DIFFUSION AND DRIFT, P-NJUNCTION.

MODULE 2 : ELECTRONIC MATERIALS (8 LECTURES)

FREE ELECTRON THEORY, DENSITY OF STATES AND ENERGY BAND DIAGRAMS, KRONIG- PENNY MODEL (TO INTRODUCE ORIGIN OF BAND GAP), ENERGY BANDS IN SOLIDS, E-K DIAGRAM, DIRECT AND INDIRECT BANDGAPS, TYPES OF ELECTRONICS MATERIALS: METATLS, SEMICONDUCTORS, AND INSULATIORS, DENSITY OF STATES, OCCUPATION PROBABILITY, FERMI LEVEL EFFECTIVE MASS, PHONONS.

MODULE 3 : SEMICONDUCTOR LIGHT EMITTING DIODES (LEDS) (6 LECTURES)

RATE EQUATIOINS FOR CARRIER DENSITY, RADIATIVE AND NON- RADIATIVE RECOMBINATION MECHANISMS IN SEMICONDUCTORS, LED:DEVICE STRUCTURE, MATERIALS, CHARRACTERISTICS, AND FIGURES OF MERIT.

NISYKW 4 : SEMICONDUCTOR LASERS (5 LECTURES)

REVIEW OF LASER PHYSICS; RATE OF EQUATIONS FOR CARRIER- AND PHOTON-DENSITY, AND THEIR STEADY STATE SOLUTION, LASER DYNAMICS, RELAXATION OSCILLATIONS, INPUT-OUTPUT CHARACTERISTICS OF LASERS. SEMICONDUCTIOR LASER: STRUCTURE, MATERIALS

MODULE 5 : PHOTODETECTORS (6 LECTURES)

TYPES OF SEMICONDUCTOR PHOTODETECTORS – P- N JUNCTION, PIN AND AVALANCHE AND THEIR STRUCTURE, MATERIALS, WORKING PRINCIPLE, AND CHARACTERISTICS.

MODULE 6 : INTRODUCTION TO QUANTUM MECHANICS (6 LECTURES)

WAVE PARTICLE DUALITY, COMPTON EFFECT AND PHOTOELECTRIC EFFECT, UNCERTAINTY PRINCIPLE, PROBABILITY CURRENT DENSITY, EXPECTATION VALUES, FREE-PARTICLE WAVE FUNCTION AND WAVE-PACKETS, TIME-DEPENDENTS AND TIME INDEPENDENT SCHRODINGER EQUATION FOR WAVE FUNCTION.

SUGGESTED TEXT/REFERENCE BOOKS

- J. SINGH, SEMICONDUCTOR OPTOELECTRONICS :PHYSICS AND TECHNOLOGY, MCGRAW-HILL INC. (1995).
- B. E. A. SALEH AND M.C. TEICH, FUNDAMENTALS OF PHOTONICS, JOHN WILEY & SONS,
- S. M. SZE, SEMICONCDUCTOR DEVICES: PHYSICS AND TECHNOLOGY, WILEY (2008).
- YARIV AND P. YEH, PHOTONICS : OPTICAL ELECTRONICS IN MODERN COMMUNICATIONS, OXFORD UNIVERSITY PRESS, NEW YORK (2007),
- P. BHATTACHARYA, SEMICONDUCTIOR OPTOELECTRONIC DEVICES, PRENTICE HALL OF INDIA (1997)

List of Experiments:

1. To verify the inverse square law of radiation using Photoelectric effect.

2. To determine the value of Planck's constant and photoelectric work function of the material of the cathode using photoelectric cell.

3. To verify the existence of Bohr's energy levels with Frank-Hertz apparatus.

4. To study the V-I characteristics of semiconductor diode.

5. To find the band gap of the semiconductor material using diode in reverse bias.

6. To study the common base and common emitter characteristics of PNP/NPN junction transistor.

7. To study the characteristics of metal-oxide-field-effect transistor.