VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)

Ibrahimbagh, Hyderabad-31

DEPARTMENT OF PHYSICS

PHYSICS SYLLABUS OF FOR FACULTY RECRUITMENT (ASSISTANT PROFESSORS)TEST 2019-20

UNIT-I	**FUNDAMENTALS OF CRYSTAL STRUCTURE** Introduction-Space lattice, Basis, Unit cell, Bravais lattices and crystal systems, X-ray diffraction, Bragg's law, powder x- ray diffraction-derivation of lattice parameters for cubic crystals, crystalline, polycrystalline and amorphous materials, Miller Indices, , inter-planar spacingburger vector, burgers circuit, energy of a dislocation, effects of defects on properties of solids. NaCl, Diamond and ZnS crystal structure. Classical free electron theory (Drude theory) and its limitations, Somerfield theory, de Broglie Hypothesis, wave function, Schrodinger wave equation for a particle in I-D box, Kronig-Penny model (introduction to origin of band gap), Energy bands in solids, E-k diagram, density of states for bulk, thin and nano materials, effective mass, classification of materials as metals, semiconductors, and insulators.
UNIT-II	**QUANTUM MECHANICS** Inadequacy of classical mechanics, photo electric effect, Wave-particle duality, de Broglie waves, Davisson and Germer's experiment, G.P. Thomson experiment, wave packet, uncertainty principle, wave function and its physical significance, postulates of quantum mechanics. Time-dependent and time-independent Schrodinger equations, quantum mechanical operators, Schrodinger equation for one dimensional problems: free-particle, stationary-state, particle in infinite square-well potential, potential barrier and tunneling- calculation of transmission coefficient, alpha decay.
UNIT-III	**OPTOELECTRONIC DEVICE** **LIGHT EMITTING DIODE (LED)**: types of luminescence, construction and working of LED, characteristics of LED, quantum efficiency of LED, Homo junction and Hetero-junction structures, advantages and applications of LED. **LASERS:** meta-stable states, population inversion, pumping, components of laser; condition for lasing, characteristics of lasers, types of lasers, construction and working of Ruby laser and He-Ne laser. Semiconductor lasers- rate equations for carrier and photon-density, and their steady state solutions, modes in resonating cavity, gain and loss, quantum efficiency, construction and working of homo-junction and hetero-junction semiconductor lasers, advantages and applications of lasers. **PHOTO-DETECTORS:** photoconductivity, expression for current gain in a photoconductor, construction, working and characteristics of photo-detectors like photo-diode, PIN, and Avalanche diode, performance of photo-detectors. **SOLAR CELL**: Photovoltaic effect, air mass conditions, solar radiation spectrum, construction and working of homo and hetero junction solar cell, V-I characteristics of solar cell, quantitative treatment of spectral response, conversion efficiency, fill

	factor, thin film and tandem solar cells, applications of solar cells.
UNIT-IV	**SMART MATERIALS AND APPLICATIONS** Piezo electric effect and inverse piezoelectric effect, Piezo electric materials, Structure of Quartz crystal, Piezoelectric oscillator, Magnetostriction, Magnetostriction oscillator, piezo-electric sensors, applications of Piezo-electric materials. Pyro electric effect, pyro electric materials, pyro-electric sensors. thermoelectric effect, Seebeck effect, Peltier effect, thermoelectric sensor, Properties and applications of thermoelectric materials, thermoelectric generator and Thermoelectric cooler. Introduction to shape memory alloys (SMA)- Shape Memory Effect (SME) different phases of Shape memory alloys, Austenite, Martensite, Properties and characteristics of engineering SMAs**,** Super elasticity, one and two way shape memory effects, Properties of Ni-Ti shape memory alloy, Cu-based shape memory alloys, biomedical Materials, Advantages, disadvantages of SMAs, Applications of SMAs. Smart fluids: Magneto-rheological and Electro-rheological fluids.
UNIT-V	**MATERIAL PREPARATION AND CHARACTERIZATION** simple thermal evaporation- Chemical vapor deposition technique-Advantages and disadvantages of Chemical Vapor deposition (CVD), physical vapour deposition electron beam evaporation- RF sputtering, flash evaporation, Laser ablation- spin coating-molecular beam epitaxy (MBE), Spin coating, Film thickness measurement-ellipsometry, quartz crystal oscillator techniques, structure and microstructure of thin films. Characterization techniques: X-Ray Diffraction (XRD), working principles of Scanning Electron Microscopy (SEM), working of Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM).