Syllabus for Paper III (core)
Post code : MST1 & MST2
Taken from curriculum of first degree program –Physics & Electronics (Kerala university -2018 revised)

Circuit Theory:

Ohm's Law, Kirchhoff's law- Ideal voltage and current sources- Thevenin's and Norton's theorem, Maximum power transfer theorem

Diode circuits:

Extrinsic semiconductors-n- type and – p-type semiconductors, Diodes-PN junction diode-PN junction under forward and reverse biased conditions-r m s value and peak inverse voltage- diode characteristics-ac and dc resistances- half wave and full wave rectifiers- (average dc value of current, ripple factor and efficiency)- different types of filters (shunt capacitor, LC and RC)- break down mechanism in diodes- Zener diode-voltage regulator

Transistors:

Bipolar Junction Transistor, Theory of BJT operation- CB, CE and CC characteristics-alpha ,beta and gamma – relation between transistor currents- biasing circuits (CE configuration)- stability factors-selection of operating point-ac and dc load lines-Q point-collector feedback; base resistor and potential divider methods- BJT amplifiers- input and output-impedances-graphical analysis of CE amplifier(frequency response, band width and gain in dB)- emitter follower.

Amplifier classes and efficiency - class A operation - transformer coupled class A amplifier - class B amplifier - push pull amplifier - basic ideas of class C operation - distortion in amplifiers, Operational amplifiers.

Feedback principles – negative feedback - advantages of negative feedback - positive feedback - principle of sinusoidal feedback- oscillation - Barkhausen criterion for oscillations - RC phase shift, Hartley Oscillator, Colpitt's Oscillator.

Atomic Spectra :
Optical spectra-Spectral terms and notations - selection rules - intensity rule and interval rule - fine structure of sodium D lines – hyperfine structure-alkali spectra - Zeeman effect - Larmor's theorem – quantum mechanical explanation of normal Zeeman effect. Anomalous Zeeman effect –Paschen-Back effect-Stark effect.

X-ray Diffraction :
X-rays- Discovery- properties -scattering -Measurement of X-ray wavelengths by ruled gratings-X-ray Spectra- continuous and characteristics X- ray spectrum-Origin of continuous Spectrum -Origin of characteristic X-rays-X-ray energy level diagram. -Absorption of X-rays-Applications of X-rays

Optical Spectra

Spectral terms and notations - selection rules - intensity rule and interval rule - fine structure of sodium D lines – hyperfine structure-alkali spectra - Zeeman effect - Larmor's theorem – quantum mechanical explanation of normal Zeeman effect. Anomalous Zeeman effect –Paschen-Back Effect-Stark effect.

X-rays

Discovery- properties -scattering -Measurement of X-ray wavelengths by ruled Gratings-X-ray Spectra- continuous and characteristics X- ray spectrum. Origin of continuous Spectrum -Origin of characteristic X-Rays-X-ray energy level diagram. -Absorption of X-Rays-Applications of X-rays

Electromagnetic spectra

molecular energies-classification of molecules-rotational spectra of diatomic molecules-rotational energy levels-selection rules-rotational spectrum-isotope effect- bond length and atomic mass. Diatomic vibrational spectra-vibrational energy levels-selection rule-vibrational Transitions-Rotation-Vibration transitions-IR spectrometer Raman scattering- classical description of Raman scattering, quantum theory of Raman scattering- -vibrational Raman spectra-diatomic molecules-polyatomic molecules-rotational Raman spectra Raman spectrometer. Electronic spectra sequences and progressions-Frank-Condon principle.

Nuclear Magnetic Resonance

NMR Principle-Resonance condition-NMR spectrometer-chemical shift-indirect spin-spin Interaction- applications of NMR spectroscopy.