6) ELECTRICAL SCIENCES

i) ELECTRICAL & ELECTRONICS

Syllabus and Model Question Paper

Syllabus

PART – B

1. **Rotating Machines:** Principles of operation, EMF equation of DC machine, constructional features, classification, generator action, voltage regulation. Motor action, characteristics, applications, efficiency, Testing of DC machines, starting of DC motors. Principle of operation and constructional features of induction motor, equivalent circuit, circle diagram of IM, torque equation, starting of IM and speed control.
   Construction and operation of cylindrical rotor and salient pole synchronous generator, EMF equation, harmonics and their minimization, armature reaction, regulation by EMF method, MMF method and ZPF methods. Two reaction theory for salient pole machine. Determination of Xd and Xq from slip test, synchronization, synchronizing with infinite bus, parallel operation of two alternators, operation on infinite bus, load sharing, effect of change in excitation power angle, equation of power in terms of power angle.
   Synchronous motor: Principle of operation, V and inverted V curves, synchronous motor as synchronous condenser for pf improvement, method of starting, torque and torque angle.

2. **Transformers:** Single phase and 3-phase transformer, principle of operation, equivalent circuit, vector diagram, efficiency and regulation. Polarity test, OC and SC tests, pre determination of efficiency and regulation. Power and distribution transformer. All day efficiency, Sumpner's test, 3-phase transformer connection, 3-phase to 6-phase, Scott connection and open delta, harmonics.
   Auto Transformers: Construction, application, 3-phase autotransformers.

   Power generation, transmission and distribution: Hydel, thermal and nuclear power plants, plant factors, technologies connected with the above plants, power plant economics, major equipment in power stations, power factor improvement, substation.

MVA calculation, current limiting reactors, typical transmission and distribution schemes, overhead transmission lines. line parameters, calculation of resistance, inductance and capacitance. Short medium and long transmission lines. HVAC/DC Generation & Measurement. Insulators: types potential distribution in suspension insulators string efficiency, testing of insulators; underground cables types, material used, grading of cables, charging current, testing of cables; AC distribution system: radial and ring main system. Switch gear and protection: Fuses, circuit breakers, switches, relays, protector schemes. HVAC/DC Generation and Measurement.

3.

4. **Power Electronics:** Power semiconductor devices- power diodes- power transistors, power MOSFET, IGBT, their switching characteristics ,merits & demerits, their typical application. Thyristor Two transistor analogy, static & dynamic characteristics – turn on &turn off characteristics, gate characteristics, Triggering schemes, snubber circuits, over current and over voltage protection.

5. **Power system Analysis and computer methods in power systems:** Representation of power systems components: single line diagram, per unit concept. Symmetrical 3 phase faults: short circuit current and selection of circuit breaker. Symmetrical components: Resolution of unbalanced voltage and current into their symmetrical components. Power in terms of symmetrical components, positive, negative and zero sequence networks of power systems. Power system stability; Steady state and transient stability. Swing equation, equal area criteria and its application. Load flow studies, solution of load flow studies by Gauss Sidal, N.R method and fast decoupled method, Economic operation of power system.

6. Classification of electric drives, heating and power rating of motors, Industrial drives and electric traction.

MODEL QESTIONS

Section-I of Part-B

Each Question Carries One Mark:

1. The armature of DC motor is laminated to

(a) Reduce the bulk
(b) Provide passage for air cooling
(c) Insulate the core
(d) Reduce eddy current losses

2. The inertia constant of two groups of machines which swings together are

(a) M_1+M_2
(b) $M_1+M_2+2M_1M_2$
(c) $\frac{M1M2}{(M1+M2)}$
(d) $\frac{\text{Maximum load}}{\text{Average load}}$

3. The capacity factor of plant is given by

(a) $\frac{\text{Maximum load}}{\text{Plant capacity}}$ (b) $\frac{\text{Average load}}{\text{Maximum load}}$

(b) $\frac{\text{Average load}}{\text{plant capacity}}$ (d) $\frac{\text{Maximum load}}{\text{Average load}}$

4. Feeders are designed mainly from point of view of

(a) Its current capacity (b) Voltage drop in it cooling
(c) Voltage rating (d) Operating frequency

5. The Unit protection scheme provides

(a) Primary protection (b) backup protection
(c) Simultaneous Protection (d) Remote protection

MODEL QUESTIONS
Section-II of Part-B

Each Question Carries Two Marks:

1. A 5 KVA, 230 volts, 50 Hz single phase transformer has an eddy current loss of 30 watts. The eddy current loss of the same transformer when excited by DC source of same voltage is

(a) 30 watts (c) Less than 30W
(c) More than 30W (d) Zero watt

2. A 66KV system has string insulator having five discs and the earth to disc capacitance ration is 0.1. The string efficiency will be

(a) 89% (b) 75%
(c) 67% (d) 55%

3. If the penalty factor of a plant is unity, its increment transmission loss is

(a) 11.0 (b) -1.0
(c) Zero (d) None

4. A second order system has a transfer function given by

$$G(S)=\frac{25}{S^2+8S+25}$$

If the system is initially at rest subjected to a unit step input at t=0, a second peak in the response will occur at

(a) Π sec (b) $\Pi/3$ sec
(c) $2\Pi/3$ sec (d) $\Pi/2$ sec

6. 3-phase balanced load which has a power factor of 0.707 is connected to a balanced supply. The power consumed by the load is 5Kw. The power is measured by the two-wattmeter method. The readings of the two watt meters are

(a) 3.94Kw and 1.06Kw
(b) 2.50Kw and 2.50Kw
(c) 5.0Kw and 0.0Kw
(d) 2.96Kw and 2.04Kw

ii) ELECTRONICS & COMMUNICATION ENGINEERING / TELECOMMUNICATION ENGINEERING

Syllabus

PART-B

1. **VLSI Design and Embedded Systems:** Micro-electronics, CMOS Logic structures, Scaling, Sub-system design and layout, Testability, Embedded system design and development, RTOS.

2. **Signals & Systems and DSP:** Types of Signals and Systems, properties of systems, convolution, correlation, Fourier series and transforms (Discrete Time), Z-transform, DFT and FFT, Structure for FIR & IIR system, Windowing techniques, Analog and digital filter design, FIR & IIR filter design.

3. **Analog and Digital Communication and Networking:** AM, FM, PM, digital communication sampling, digital coding of analog wave forms, ISI, digital modulation techniques - PSK, BPSK, QPSK, MSK, Spread spectrum, ISO/ OSI model, TCP/IP model, Internet working. Wireless Communication- Cellular concept, Cell fundamentals, Capacity expansion techniques, Mobility management, GSM channel concept, CDMA channel concept, Diversity techniques, Wireless LAN.

4. **Micro Waves and Antennas:** Transmission lines, Characteristic impedance, impedance transformation, Passive and active microwave devices, microwave measurement, Radar systems, Radio telemetry. Rectangular wave guides and Circular wave guides, Antenna parameters - Radiation pattern, Beam area, Radiation intensity, Beam efficiency, Directivity and gain, Effective height, radiation efficiency, Reciprocity theorem, Dipole antennas, Antenna arrays, Different types of antennas.

5. **Power Electronics:** Diodes, transistors, amplifiers, voltage regulators and power supplies, characteristics of DIAC, TRIAC, MOSFET, IGBT, Thyristors and its control circuits, control rectifiers, commutation techniques, AC voltage controller.

6. **8086 Microprocessor** - Architecture, Memory Segmentation, Addressing Modes, Instruction set, I/O interfacing, 8255, 8253.

MODEL QUESTIONS
SECTION -I OF Part –B

Each question caries One Marks

1) Which of the following provides the library interface to allow C programs to call standard I/O functions?

(a) TNX (b) RTL (c) IFX (d) MPV

2) The input x(t) and output y(t) of a continuous-time system is related as

$$y(t) = \int_{t-T}^{t} x(u).du$$

Then, the system is
(a) Linear and time-variant (b) linear and time-invariant
(b) Linear and time-variant (c) linear and time-invariant

3) Broad banding a microwave transistor RF amplifier is difficult because

(a) of shunt capacitance loading effect.
(b) of series capacitance loading effect.
(c) Changes in inductive loading affect terminating impedance
(d) Changes in output loading affect input impedance

4) The effect of the following instructions on register AX is

```
PUSH AX
ADD AX, 4
POP BX
MOV CX, AX
PUSH BX
POP AX
```

(a) leave it with its original value (b) add 4 to it
(c) clear it (d) double it

5) IGBT stands for

(a) Insulated Gate Bipolar Transistor
(b) Insulated Gate Base Transistor
(c) Integrated Gate Bipolar Transistor
(d) None of the above

MODEL QUESTIONS
SECTION -II OF PART· B

Each question carries Two marks

1) Two *n*-channel MOSFETs T1, T2 are identical in all respects except that the width of T2 is double that of T1. Both the transistors are biased in the saturation region operation, but the gate override voltage (V_{GS} - V_{TH}) of T2 is double that of T1, where V_{GS} and V_{TH} are the gate-to- source voltage and threshold voltages of transistors, respectively. If the drain current and transconductance of T1 are I_{D1} and g_{m1}, respectively. The corresponding values of these two parameters for T2 are

(a) $8I_{D1}$ and $2g_{m1}$ (b) $8I_{D1}$ and $4g_{m1}$ (c) $4I_{D1}$ and $4g_{m1}$ (d) $4I_{D1}$ and $2g_{m1}$

2) An FM signal is being broad cast in the 88.108 MHz band having a carrier swing of 125 KHz. The modulation index is

a) 100% b) 83% c) 67% d) 50%

3) The minimum distance at which the same frequency can be reused for radius of the cell R=5 km and cluster size N=7 is

(a) 26.03 km (b) 22.91 km (c) 32.25 km (d) 31.14 km

4) The bit rate of a digital communication system is 34M bit/s. The modulation scheme is QPSK. The baud rate of the system is

(a) 68M bit/s (b) 34 M bit/s (c) 17 M bit/s (d) 8.5 M bit/s

5) A transistor drives a loud speaker through 8255, which one of the following program generates an alarm

(a)
```
MOV AL, 01
OUT DX, AL
MOV AL, 00
OUT DX, AL
```

(b)
```
MOV AL, 01
CALL DELAY
OUT DX, AL
MOV AL, 00
OUT DX, AL
```

(c)
```
MOV AL, 01
OUT DX, AL
CALL DELAY
MOV AL, 00
OUT DX, AL
```

(d)
```
MOV AL, 01
OUT DX, AL
MOV AL, 00
OUT DX, AL
CALL DELAY
```

6) ELECTRICAL SCIENCES

iii) INSTRUMENTATION TECHNOLOGY

Syllabus and Model Question Paper

Syllabus

PART-B

1. **Functional Elements of Instrument and Measurement System:** Instruments and measurement systems, different types of instruments, functions of instruments and measurement systems, applications of measurement systems, Elements of generalized measurement system, Input-output configuration of measuring instruments and measurement systems, methods of correction for interfering and modifying inputs. Transducers, Classifications of transducers.

2. **Electronic Instrumentation and Measurements:**

   Static and dynamic characteristics of measurement systems, Standards and calibration, Gross errors and systematic errors, Absolute and relative errors, basic concepts of accuracy, precision, resolution and significant figures, Measurement error combinations and error analysis.

3. **Process Instrumentation:** Transducers and sensors for the measurement of displacement, level, stress & stress, Force & torque, pressure, temperature, flow, vibration, density, viscosity, turbidity, humidity & moisture, sound, speed and thickness.

4. **Process Control:** Introduction to process control, final control. Controller principles- all types of dis-continuous and continuous controllers, analog and digital controllers. Control loop characteristics, Multivariable control, feed forward control, cascade control, modeling and simulation from plant automation, industrial control applications, Programmable logic controllers (PLC) –Introduction, design and programming.

5. **Analytical, Optical and Biomedical Instrumentation:**

   Analytical Instrumentation: Introduction, Principles of UV, visible and IR spectroscopy. Flame emission spectroscopy and Atomic absorption spectroscopy, Chromatography.

   Optical Instrumentation: Fundamentals of lasers, solid and semiconductor lasers and their characteristics. Applications of lasers-interferometers and holography. Basics of fiber optics

   Biomedical Instrumentation: Biomedical transducers & electrodes. Instrumentation and recording of ECG, EEG, respiratory rate, blood pressure and blood flow. Cardiac pacemakers and defibrillators.

6. **Signals and Systems, DSP:** Types of Signal and Systems, properties of systems, convolution correlation, Fourier series and transforms (Discrete Time) Z-transform, DFT and FFT, windowing techniques, analog and digital filter design, IIR, FIR filter design.

MODEL QESTIONS

Section-I of Part-B

MODEL QESTIONS

Section-II of Part-B

- To be appended by Instrumentation BOS board

6) ELECTRICAL SCIENCES

iv) BIOMEDICAL ENGINEERING & MEDICAL ELECTRONICS

Syllabus and Model Question Paper

Syllabus

PART – B

1. **Human Anatomy and Physiology:** Homeostasis, types of tissues, cardiovascular system, nervous system, respiratory system, skeletal and muscular system, digestive system.
2. **Biomedical Instrumentation:** Biomedical transducers & electrodes, Sources of bioelectric potentials. Bioelectric signals- ECG, EEG, EMG. Defibrillators, Cardiac pacemakers, Implantable pacemakers, Respiratory measurement, blood pressure and blood flow meters, Audiometers.
3. **Medical Imaging Systems:** X-ray and radiography, Computed tomography, Ultrasound imaging, Radionuclide imaging, Magnetic resonance imaging.
4. **Signals & Systems and DSP:** Types of Signals and Systems, Properties of Systems, Convolution, Correlation, Discrete Time Fourier series and Discrete Time Fourier transforms. Z-transform, DFT and FFT, windowing techniques, analog and digital filter design, IIR, FIR filter design.
5. **Bio-Medical Signal Processing:** Digital filters, IIR filters – smoothing, notch, Derivatives, Sampling, Integer filters, Data Reduction techniques, Signal averaging. ECG signal processing, QRS detection – power spectrum of ECG, BP filtering techniques, Different template matching techniques. EEG signal processing and analysis.
6. **Medical Image Processing:** Image sampling and quantization, Enhancement in spatial domain, Properties of 2D Fourier Transform, Enhancement in frequency domain, Basic compression methods, Image compression standards, Edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation, Color image processing.

MODEL QESTIONS

Section-I of Part-B

MODEL QESTIONS

Section-II of Part-B

- *To be appended by Instrumentation BOS board*