QUESTION PAPER

2.1 Main Papers

(a) The question paper will be for a total of 150 marks divided into three groups:

(i) **Group I**: Question Numbers 1 to 20 (20 questions) will carry one mark each (subtotal 20 marks).

(ii) **Group II:** Question Numbers 21 to 75 (55 questions) will carry two marks each (subtotal 110 marks). Out of this, Q.71 to Q.75 may be *questions based on common data.*

(iii) **Group III:** Question Numbers 76 to 85 (10 questions) will carry two marks each (subtotal 20 marks). These questions are called *linked answer questions.* These 10 questions comprise five pairs of questions (76 & 77, 78 & 79, etc.). The solution to the second question of each pair (e.g. Q.77) will be linked to the correct answer to the first one (e.g. Q.76) in the pair.

(b) Each question will have four choices for the answer. **Only one** choice is correct.

(c) Wrong answers carry 25% negative marks. In Q.1 to Q.20, **0.25** mark will be deducted for each wrong answer and in Q.21 to Q.76, Q.78, Q.80, Q.82 and Q.84, **0.5** mark will be deducted for each wrong answer. However, there is no negative marking in Q.77, Q.79, Q.81, Q.83 and Q.85.

(d) Papers bearing the code AE, AG, CE, CH, CS, EC, EE, IN, IT, ME, MN, MT, PI, TF will contain questions on Engineering Mathematics to the extent of 20 to 25 marks.

(e) The multiple choice objective test questions can be of the following type:

(i) **Each choice containing a single stand-alone statement/phrase/data.**

Example

Q. The phenomenon known as “Early Effect” in a bipolar transistor refers to a reduction of the effective base-width caused by

(A) electron-hole recombination at the base
(B) the reverse biasing of the base-collector junction
(C) the forward biasing of emitter-base junction
(D) the early removal of stored base charge during saturation-to-cutoff switching

(ii) **Each choice containing a combination of option codes.**
The question may be accompanied by four options P, Q, R, S and the choices may be a combination of these options. The candidate has to choose the right combination as the correct answer.

Example

Q. Choose the correct combination of true statements from the following:

P: The ratio of isentropic to isothermal bulk modulus for a gas is equal to its specific heat ratio (C_P / C_V)
Q: The viscosity of gas is an increasing function of temperature
R: The viscosity of a gas is a decreasing function of temperature

S: The compressibility co-efficient of a gas decreases with increase in Mach number

(A) Q, S (B) R, S (C) P, S (D) P, Q

(iii) **Assertion[a]/Reason[r] type** with the choices stating if [a]/[r] are True/False and/or stating if [r] is correct/incorrect reasoning of [a]

Example

Q. Determine the correctness or otherwise of the following assertion and reasoning:
Assertion [a]: Bernoulli's equation can be applied along the *central streamline* in a steady laminar fully-developed flow through a straight circular pipe.

Reason [r]: The shear stress is zero at the centre-line for the above flow.

(A) Both [a] and [r] are true and [r] is the correct reason for [a]
(B) Both [a] and [r] are true but [r] is not the correct reason for [a]
(C) Both [a] and [r] are false
(D) [a] is false but [r] is true

(iv) **Match items**: Match all items in Group 1 with correct options from those given in Group 2 and choose the correct set of combinations from the choices E, F, G and H.

Example

Q. Find the correct match between Group 1 and Group 2

Group 1	Group 2
E- Varactor diode	1- Voltage reference
F- PIN diode	2- High-frequency switch
G- Zener diode	3- Tuned circuits
H- Schottky diode	4- Current controlled attenuator

(A) E-4, F-2, G-1, H-3 (B) E-2, F-4, G-1, H-3

(C) E-3, F-4, G-1, H-2 (D) E-1, F-3, G-2, H-4

(v) **Common data questions**: Multiple questions may be linked to a common problem data, passage and the like. Two or three questions can be formed from the given common problem data. Each question is independent and its solution obtainable from the above problem data/passage directly. (Answer of the previous question is not required to solve the next question). Each question under this group will carry two marks.

Example

Common Data for Questions 74 & 75:

$KMnO_4$ reacts with oxalic acid in the presence of excess H_2SO_4 to yield a manganese complex X which is colorless in dilute solutions and pale pink in the crystalline form [atomic number of manganese is 25].

Q.74 The number of unpaired electrons present in the complex X is

(A) 1 (B) 3 (C) 4 (D) 5

Q.75 The calculated spin only magnetic moment for the compound X is

(A) 5.92 BM (B) 4.90 BM (C) 3.87 BM (D) 1.73 BM

(vi) **Linked answer questions**: These questions are of problem solving type. A problem statement is followed by two questions based on the problem statement.

The two questions are to be designed such that the solution to the second question depends upon the answer to the first one. In other words, the first answer is an intermediate step in working out the second answer. Each question in such 'linked answer questions' will carry two marks.

Example

Statement for Linked Answer Questions 82 & 83:

Consider a unity-gain feedback control system whose open-loop transfer function is

$$G(s) = \frac{as+1}{s^2}$$

Q.82 The value of "a" so that the system has a phase-margin equal to $\pi/4$ is approximately equal to

(A) 2.40 (B) 1.40 (C) 0.84 (D) 0.74

Q.83 With the value of "a" set for a phase-margin of $\pi/4$, the value of unit-impulse response of the open-loop system at *t=1* second is equal to

(A) 3.40 (B) 2.40 (C) 1.84 (D) 1.74

2.2 **XE/XL Papers**

(a) XE and XL papers contain a number of sections as given in Section 2.2. Each Section is of 50 marks. Each Section will be fully objective type and the questions are divided into three groups.

(i) Group I: Question Numbers 1 to 6 (6 questions) will carry one mark each (subtotal 6 marks).

(ii) Group II: Question Numbers 7 to 24 (18 questions) will carry two marks each (subtotal 36 marks). Out of this, Q.23 and Q.24 may be *questions based on common data.*

(iii) Group III: Question Numbers 25 to 28 (4 questions) will carry two marks each. These questions are called *linked answer questions.* These 4 questions comprise two pairs of questions (25 & 26 and 27 & 28). The solution to the second question of each pair (e.g. Q.26) will be linked to the correct answer to the first one (e.g. Q.25) in the pair (subtotal 8 marks).

(b) All questions have four choices with only one being correct.

(c) Wrong answers carry 25% negative marks. In Q.1 to Q.6 of each section, **0.25** mark will be deducted for each wrong answer and in Q.7 to Q.25 and Q.27, **0.5** mark will be deducted for each wrong answer. However, there is no negative marking in Q.26 and Q.28.

The pattern of multiple-choice questions is the same as in the Main papers as described in 2.5(e).