

Sl. No.

A-FRF-M-DSB

**ELECTRONICS AND
TELECOMMUNICATION
ENGINEERING**

PAPER II
(CONVENTIONAL)

Time Allowed : Three Hours

Maximum Marks : 200

INSTRUCTIONS

**Please read each of the following instructions
carefully before attempting questions**

Candidates should attempt FIVE questions in all.

*Question No. 1 is compulsory. Out of the
remaining SIX questions attempt any FOUR.*

*All questions carry equal marks. The number of
marks carried by a part of a question is
indicated against it.*

Answers must be written in ENGLISH only.

*Assume suitable data, if necessary and indicate
the same clearly.*

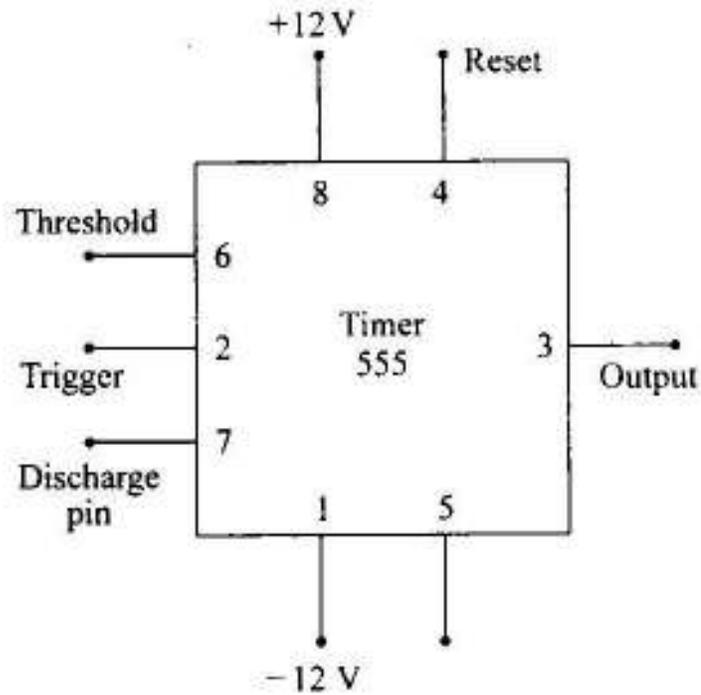
*Unless otherwise mentioned, symbols and
notations have their usual standard meanings.*

Neat sketches may be drawn, wherever required.

*All parts and sub-parts of a question are to be
attempted together in the answer book.*

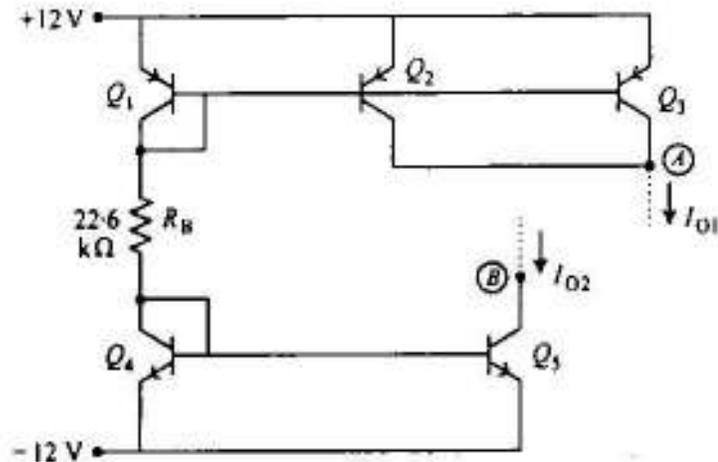
*Any pages left blank in the answer book must be
clearly struck out.*

1. (a)



In the IC Timer 555 shown in the above figure determine the reference levels for the two comparators inside the chip. Justify your answer by drawing a block diagram of the internal circuit of IC Timer 555. 5

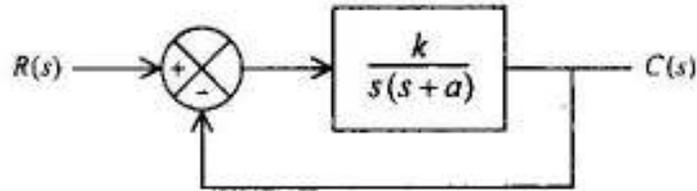
(b)



Assuming matched transistors with large β (i.e. negligible base currents), determine the currents I_{O1} and I_{O2} in the circuit given in the above figure. Assume that nodes (B) and (A) are connected at appropriate voltages which ensure that transistors Q_5 , Q_2 and Q_3 are in active region. 5

(c) Find the minimum expression of $Y = \pi m(0, 1, 3, 5, 6, 7, 10, 14, 15)$ in product-of-sum (POS) form. 5

(d)



If the resonant peak (M_r) and resonant frequency (W_r) of the closed-loop frequency-response of the system given above are $M_r = 1.04$ and $W_r = 11.55$ rad/sec, find the values of k and a . 5

(e) Find the ratio of stimulated emission rate to the spontaneous emission rate operating at a temperature of 200°C and the average operating wavelength is $1 \mu\text{m}$. 5

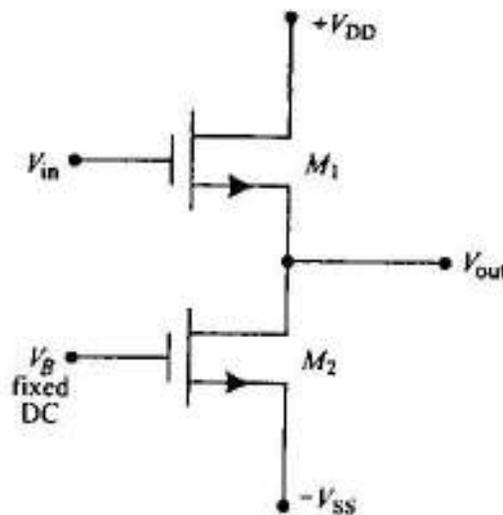
(f) An optical fibre with a core diameter $2 \mu\text{m}$ and core refractive index of 1.48 and a cladding refractive index of 1.46 . Determine

(i) the critical angle at the core-cladding interface,

(ii) the numerical aperture for the fibre. 5

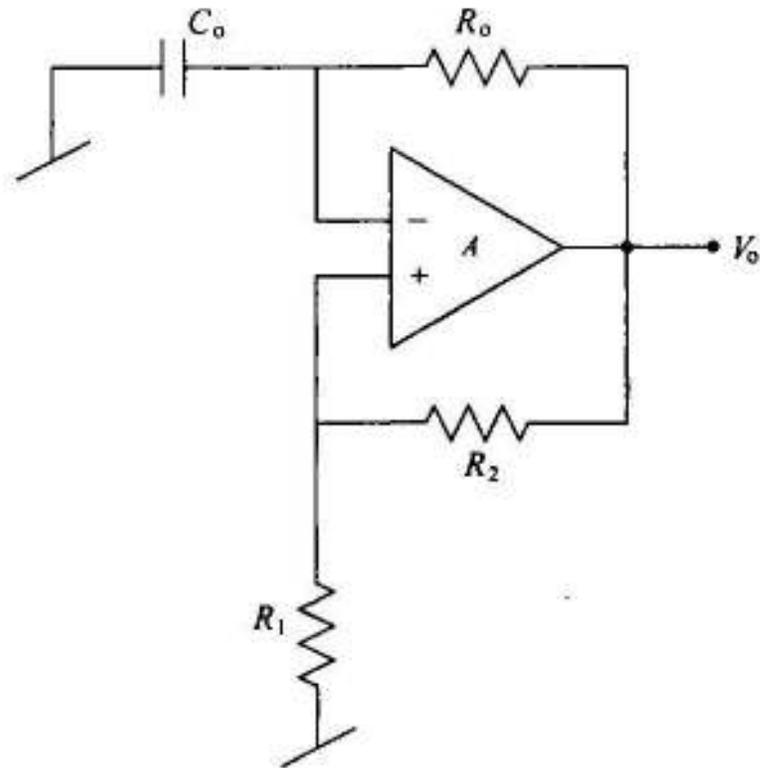
- (g) Give the Energy-band diagram for three valley model for InP Gunn-diode. Also compare the peak to valley current ratio for n -type GaAS and n -type InP. Why InP diode is superior to GaAS diode ? 2+2+1
- (h) Convert Hexadecimal number A5F1 to equivalent octal number. 5

2. (a)

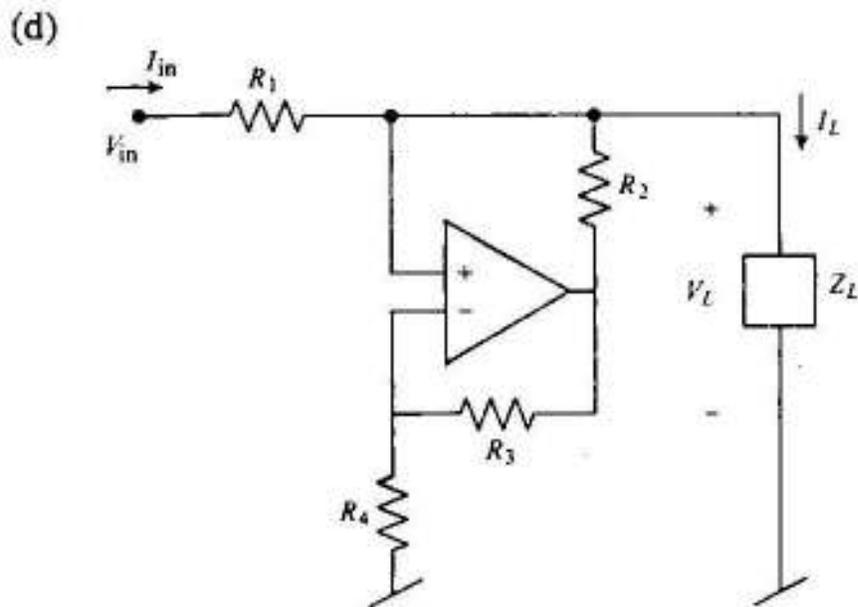


The above figure shows a source follower using n -channel MOSFETs. Assuming that M_1 and M_2 both are in saturation and have different transconductance parameters K_1 and K_2 where $K_i = \frac{\mu_n \text{COX}}{2} \left(\frac{W}{L} \right)_i$; $i = 1, 2$ and symbols have their usual meaning. Derive an expression for V_{out} in terms of V_{in} , V_{DD} , V_S , V_B , V_{th} and K_1 , K_2 . Find out the small signal voltage gain and DC offset voltage appearing at the output. 10

(b)



Assuming the gain A of the op-amp to be represented by $A \equiv \frac{\omega_t}{s}$ where ω_t is the gain-bandwidth-product of the op-amp, analyze the given circuit and determine under what condition, the circuit can generate sinusoidal signal at the output? What is the frequency of the output waveform if $R_1 = 1 \text{ K}\Omega$, $R_2 = 9 \text{ K}\Omega$, $C_o = 0.1 \text{ }\mu\text{F}$ and $R_o = 10 \text{ K}\Omega$? 10



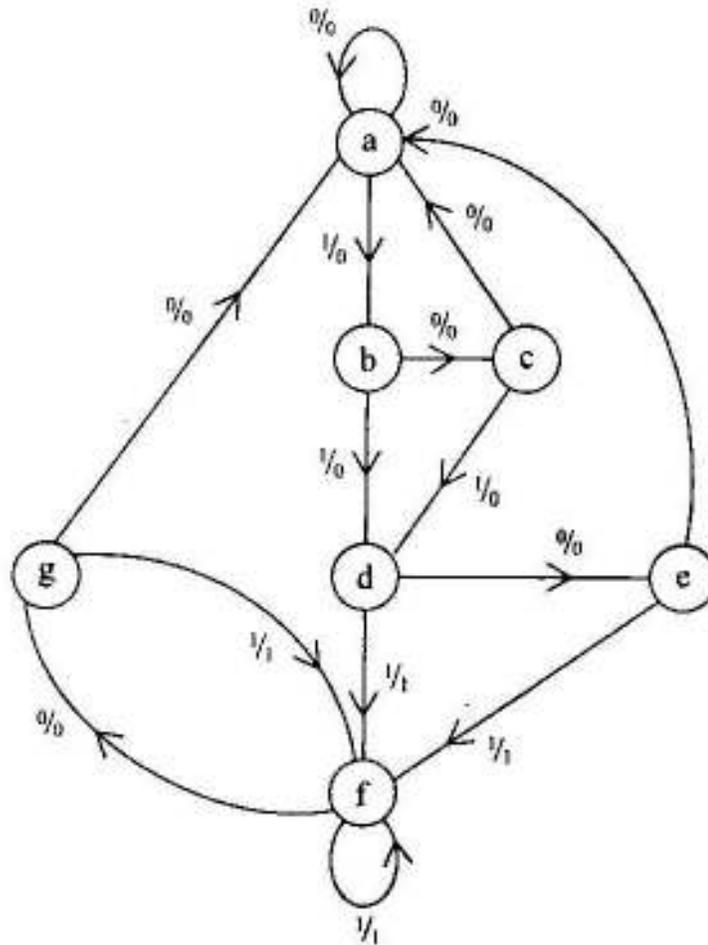
Explain the operation of the circuit shown in the above figure and determine under what condition the output current (I_L) can be made independent of load voltage? 10

3. (a) Design a counter that has a repeated sequence of six states as given in the table below :

Count Sequence		
A	B	C
0	0	0
0	0	1
0	1	0
1	0	0
1	0	1
1	1	0

20

- (b) Reduce the following state diagram and also write the reduced state table. 20



There are infinite number of input sequences that can be considered. Consider the input sequence 01010110100 starting from the initial state 'a'.

4. (a) Consider a feedback system whose open-loop transfer function is given by

$$G(s)H(s) = \frac{K}{s(1+Ts)}, \text{ where } K > 0 \text{ and } T > 0.$$

Using the Nyquist stability criterion, find whether the closed-loop system is stable or not. 20

- (b) Using polar plot method, find the gain margin of a feedback system whose open-loop transfer function is given by

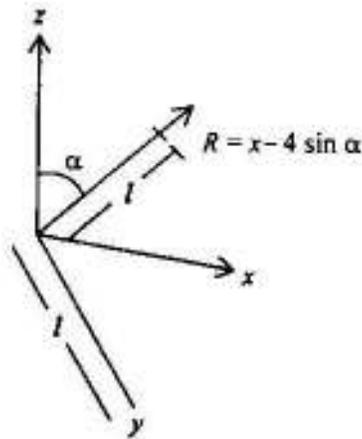
$$G(s)H(s) = \frac{0.75}{s(1+s)(1+0.5s)}, \quad 10$$

- (c) Consider a feedback system with characteristic equation

$$1 + \frac{K}{s(s+1)(s+2)} = 0.$$

Compute the angles of the asymptotes of the root-locus branches with the real axis of the s -plane. Also find the centroid and the breakaway points of the root-locus of the system. Assume that K varies from 0 to ∞ . 10

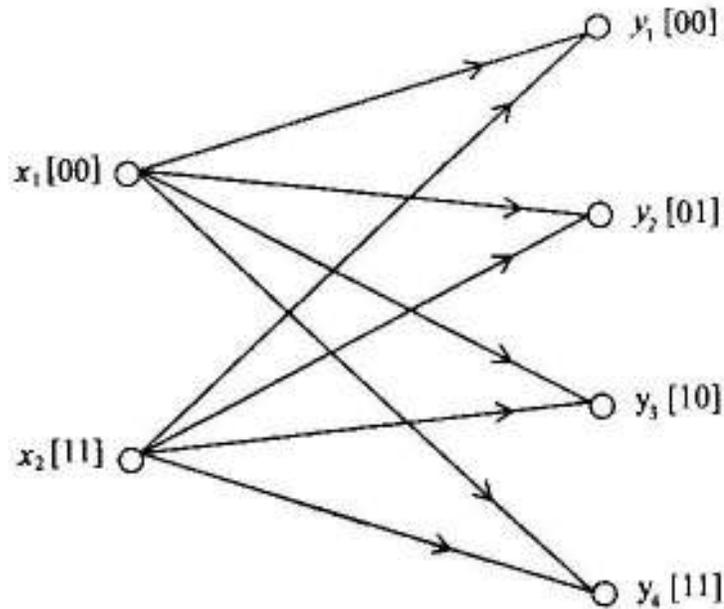
5. (a) Assume a Binary symmetric channel with probability of incorrect reception $(p) = \frac{1}{4}$ and probability of correct reception $(q) = \frac{3}{4}$. Let all the transmitted symbols $\{x_1, x_2\}$ be equally probable i.e. $p(0) = p(1) = \frac{1}{2}$. Calculate the improvements in rate of transmission by 2 and 3 repetitions of the input. 10
- (b) Evaluate the radiation or far-field of short Magnetic Dipole and its equivalent small loop. 10
- (c)



A V-shaped antenna is shown in the above figure. The current distribution on the antenna is given by $I = I_0 \cos(K_0 u)$ and the length of the antenna is l . Find the maximum field strength along the x -axis if $l = \frac{\lambda}{4}$ and $\alpha = 45^\circ$.

10

(d)



Calculate the rate of joint information transmission for the above channel. Assume $p(x_1) = p(x_2) = \frac{1}{2}$ where $[X] = \{x_1, x_2\}$ is the set of input symbols.

Assume $q \rightarrow$ Probability of correct reception.
 $p =$ Probability of incorrect reception
 and

$[Y] = \{y_1, y_2, y_3, y_4\}$ be the set of received symbols. 10

6. (a) Give the small signal equivalent circuit of MESFET (Metal Semiconductor Field Effect Transistor). Identify intrinsic elements and extrinsic elements in the small signal circuit. A certain MESFET has the following parameters :

$$R_s \text{ (source gate resistance)} = 3 \Omega$$

$$R_i \text{ (input resistance)} = 2.5 \Omega$$

$$g_m \text{ (transconductance)} = 50 \text{ m}\mathcal{U}$$

$$R_d \text{ (drain resistance)} = 450 \Omega$$

$$R_s \text{ (source resistance)} = 2.5 \Omega$$

$$C_{gs} \text{ (gate source capacitance)} = 0.65 \text{ pF}$$

Determine

- (i) the cut-off frequency and
- (ii) maximum operating frequency. 4+2+4

- (b) Calculate the power gain of a horn antenna of square aperture, have the dimension of each side as 4λ .

The power gain of a circular mouth parabolic antenna is 1600 at a wavelength of 10 cm. Calculate the diameter of the mouth and half power beam width of the antenna.

What are the drawbacks of parabolic reflectors ? 4+3+3

- (c) Define critical frequency, skip distance and maximum usable frequency. What are two most important layers of ionosphere for communication? A geostationary communication satellite has an uplink frequency of 6 GHz with antenna elevation of 5°. If the transmitter power is 1 kW and the antenna gain of the transmitter and receiver are 60 dB respectively, calculate the received power at the input of the satellite receiver. 6+4

- (d) What is a Bolometer? How many types of Bolometer exist?

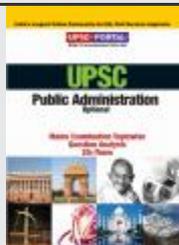
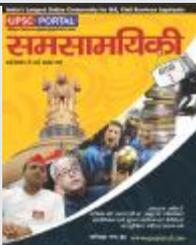
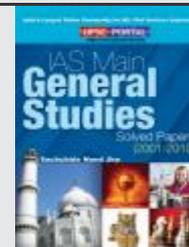
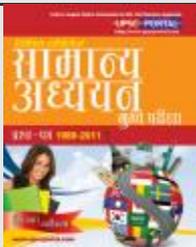
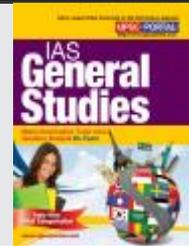
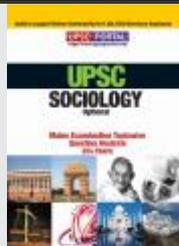
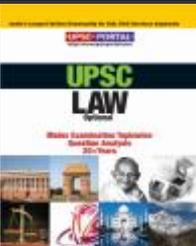
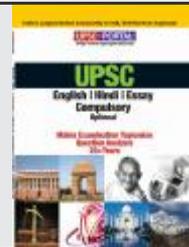
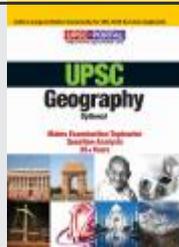
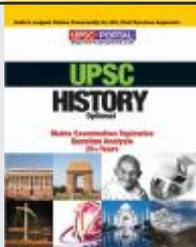
Two directional couplers (20 dB) are used in a guide to sample the incident and reflected powers. The outputs of the two couplers are 3 MW and 0.1 MW respectively. What is the value of VSWR in the main waveguide and the value of reflected power? 1+3+6

7. (a) Write a C program for Bubble Sorting a list of 8 numbers given in your program. The exact numbers may be arbitrarily chosen. 10

- (b) Show a complete simple block diagram of a typical computer in as much details as possible, explaining briefly the role of each block particular those of
- (i) Control Unit
 - (ii) Main Memory. 10
- (c) Explain different types of interrupts available in an 8085 microprocessor in details. 10
- (d) (i) Draw complete block diagram for processor to memory communication. 5
- (ii) Draw complete block diagram for processor to I/O communication. 5
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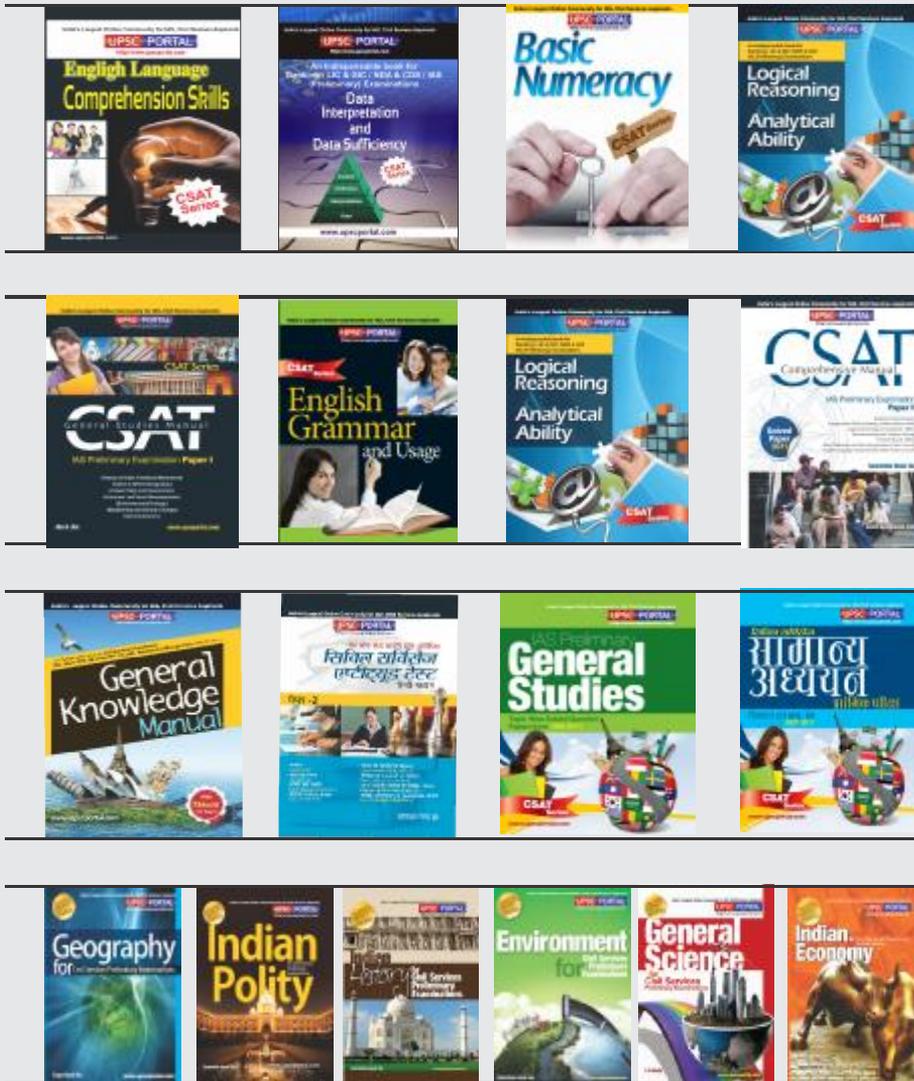
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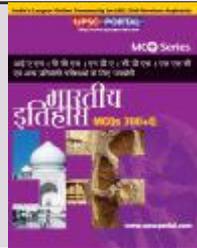
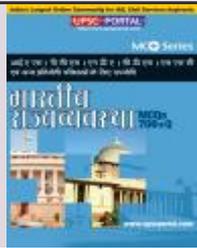
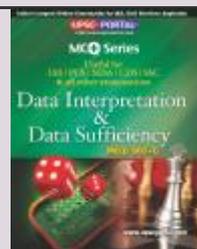
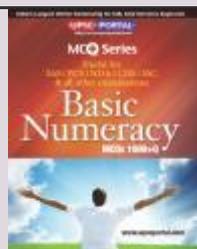
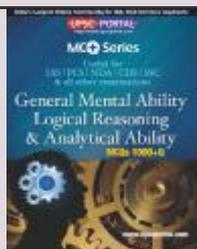
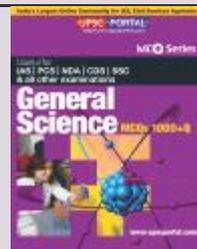
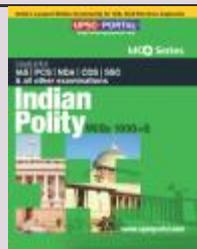
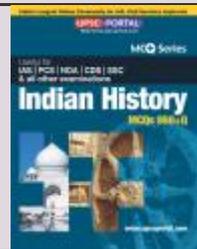
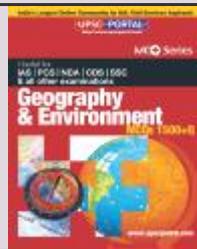
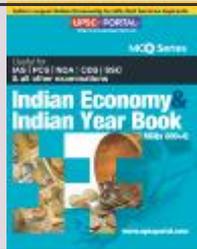
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65	E14-I.B.P.S .P.O GUIDE (ENGLISH)		9789382732471	365
66	F01-CDS Solved Paper		9789381362129	295
67	F02-NDA NA Solved Paper		9789381362136	325
68	F03-SCRA-Practice Book Solved Papers		9789381362280	325
69	F04-A COMPREHENSIVE GUIDE FOR CAPF		9789381362785	310
70	F05-NDA PRACTICE PAPERS		9789382732013	200
71	F06-SCRA PRACTICE PAPERS		9789382732051	220
72	F07-CDS PRACTICE PAPERS		9789382732037	200
73	F08-LIC AAO		9789382732341	390
74	F09-DSSSB(HINDI)		9789382732273	290
75	F10-DSSSB(ENGLISH)		9789382732280	320
76	F11-A Authentic Practice Book for Delhi Police S.I. & CAPFs S.I. CISF (A.S.I) Examination		9789382732396	170
77	F12- A Authentic Guide for Delhi Police S.I. & CAPFs S.I. CISF (A.S.I) Examination		9789382732389	375
78	F13-GIC Assistants in Public Sector: General Insurance Companies		9789382732594	380
79	F14-UTTER PRADESH LEKHPAL BHARTI PRARIKSHA		9789382732693	150
80	F15-utter pradesh arakshi bharti parikasha 2013		9789382732662	155

81	G01-Geography & Environment MCQ		9789381362402	160
82	G02-General Science MCQ		9789381362433	120
83	G03-Indian Polity MCQ		9789382732259	95
84	G04-Indian History MCQ		9789382732327	95
85	G05-Basic Numeracy MCQ		9789381362464	130
86	G06-Indian Economy & Year Book MCQ		9789381362440	120
87	G07-Reasoning Analytical Ability MCQ		9789381362488	130
88	G08-DIDS MCQ		9789381362471	130
89	G09-Bhartiya Itihas		9789381362587	95
90	G10-Bhartiya Rajyavyavastha		9789381362570	80
91	G11-SSC MCQ		9789381362686	80

Total Unit	
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- All dispute will be settled in Delhi Jurisdiction.

DD. No.: Amount (in words):
Date: Name of Bank & City:

(Sign)
