(-) Initial Margin	= ₹ 1,73,000
Gain	= ₹ 18,000

Question – 17

Sensex futures are traded at a multiple of 50. Consider the following quotations of Sensex futures in the 10 trading days during February, 2009:

Day	High	Low	Closing
4-2-09	3306.40	3290.00	3296.50
5-2-09	3298.00	3262.50	3294.40
6-2-09	3256.20	3227.00	3230.40
7-2-09	3233.00	3201.50	3212.30
10-2-09	3281.50	3256.00	3267.50
11-2-09	3283.50	3260.00	3263.80
12-2-09	3315.00	3286.30	3292.00
14-2-09	3315.00	3257.10	3309.30
17-2-09	3278.00	3249.50	3257.80
18-2-09	3118.00	3091.40	3102.60

Abhishek bought one sensex futures contract on February, 04. The average daily absolute change in the value of contract is ₹ 10,000 and standard deviation of these changes is ₹ 2,000. The maintenance margin is 75% of initial margin.

You are required to determine the daily balances in the margin account and payment on margin calls, if any.

(SM TYK – 14)

Solution:

Initial Margin = $\mu + 3\sigma$

= 10,000 + (3 × 2000)

= ₹ 16,000

Maintenance Margin = 16,000 × 75%

= ₹ 12,000

Margin A/c (Long)

Day	Closing Price	Profit Loss	Margin A/c (₹)	Balance
04/02/09	3296.50	-	-	16,000
05/02/09	3294.40	(3294.40 – 3296.50) × 50 = -105	-	15,895
06/02/09	3230.40	(3230.40 – 3294.40) × 50 = - 3200	-	12,695
07/02/09	3212.30	(3212.30 – 3230.40) × 50 = - 905	4210	16,000
10/02/09	3267.50	(3267.50 – 3212.30) × 50 = - 2760	-	18,760
11/02/09	3263.80	(3263.80 – 3267.50) × 50 = -185	-	18,575
12/02/09	3292.00	(3292.00 – 3263.8) × 50 = 1410	-	19,985
14/02/09	3309.30	(3309.30 – 3292.00) × 50 = 865	-	20,850
17/02/09	3257.80	(3257.80 – 3309.30) × 50 = -2575	-	18,275
18/02/09	3102.60	(3102.60 – 3257.80) × 50 = -7760	5485	16,000

(VI) VALUATION OF FUTURE

Question – 18

The following data relate to Anand Ltd.'s share price:

Current price per share ₹ 1,800

6 months future's price/share ₹ 1,950

Assuming it is possible to borrow money in the market for transactions in securities at 12% per annum, you are required:

(i) to calculate the theoretical minimum price of a 6-months forward purchase; and

(ii) to explain arbitrate opportunity.

(SM TYK – 02)

Solution:

(1) Theoretical Future Price

F = S (1 + r) – D

= 1,800 (1.06) – 6 = ₹1,908

= ₹435

(2) Arbitrage

(i) Action: Since future is overpriced, hence sell future & buy spot

(ii) Process

Today

- Borrow ₹ 1,800 & buy stock
- Contract to sell such stock at future price ₹ 1,950

After 6 Months

Cash Inflows

Sell share at future price	= ₹ 1,950
Cash outflows	
Repayment of Borrowing ₹ 1,800 (1.06)	= ₹ 1,908
Arbitrage Gain	= ₹ 42

Question – 19

Calculate the price of 3 months PQR futures, if PQR (FV ₹ 10) quotes ₹ 220 on NSE and the three months future price quotes at ₹ 230 and the one month borrowing rate is given as 15 percent per annum and the expected annual dividend is 25 percent, payable before expiry. Also examine arbitrage opportunities.

(SM TYK – 04)

Solution:

(1) Theoretical Future Price

F = S (1 + r) – D

= ₹ 220 (1.0375) – 2.5

= ₹ 225.75

(2) Arbitrage

(i) Action: Since future is overpriced. Hence, buy spot & sell future.

(ii) Process:

Today:

- Borrow ₹ 220 @ 15% p.a. for 3 months & buy spot
- Sell future @ 230

After 3 Months

Cash Flows =	Sell Stock	= +230
	Dividend	= +2.50
	Repay 220(1.0375)	= –228.25
	Arbitrage Gain	= 4.25

Question – 20

The share of X Ltd. is currently selling for ₹ 300. Risk free interest rate is 0.8% per month. A three month futures contract is selling for ₹ 312. Develop an arbitrage strategy and show what your riskless profit will be 3 months hence assuming that X Ltd. will not pay any dividend in the next three months.

(SM TYK – 06)

Solution:

(I) Theoretical Future Price

F = S (1 + r)

= 300 × $(1.008)^3$

= ₹ 307.26

(II) Arbitrage

(i) Action: Since future is overpriced, hence buy spot & sell future.

(ii) Process

Today

- Borrow ₹ 300 @ 0.8% p.m. & buy share
- Sell future at ₹ 312

After 3 Months

Sell Stock	= + 312
Repay $300(1.08)^3$	= 307.27
Arbitrage Gain	= 4.74

Note: यदि rate per month दिया है तो monthly compounding लेना है।

Question – 21

The 6-months forward price of a security is ₹ 208.18. The borrowing rate is 8% per annum payable with monthly rests. What should be the spot price?

(SM TYK – 01)

Solution:

Forward Price $= S(1 + r)^n$

$208.18 = S(1.0067)^6$

$S = ₹ 200$

Question – 22

On 31-8-2011, the value of stock index was ₹ 2,200. The risk free rate of return has been 8% per annum. The dividend yield on this Stock Index is as under:

Month	Dividend Paid p.a.
January	3%
February	4%
March	3%
April	3%
May	4%
June	3%

July	3%
August	4%
September	3%
October	3%
November	4%
December	3%

Assuming that interest is continuously compounded daily, find out the future price of contract deliverable on 31-12-2011. Given: $e^{0.01583} = 1.01593$

(SM TYK – 03)

Solution:

Average Dividend Yield

$$= \frac{3+3+4+3}{4}$$

= 3.25% p.a.

$F = S \times e^{(r-d)t}$

$= 2,200 \times e^{(0.08 - 0.0325)4/12}$

$= 2,200 \times e^{0.01583}$

$= 2,200 \times 1.01593$

$= 2,235.046$

Question – 23

The NSE-50 Index futures are traded with rupee value being ₹100 per index point. On 15th September, the index closed at 1195, and December futures (last trading day December 15) were trading at 1225. The historical dividend yield on the index has been 3% per annum and the borrowing rate was 9.5% per annum.

(i) Determine whether on September 15, the December futures were under-priced or overpriced?

(ii) What arbitrage transaction is possible to gain out this mispricing?

(iii) Calculate the gains and losses if the index on 15th December closes at (a) 1260 (b) 1175.

Assume 365 days in a year for your calculations

(Exam November – 2019)

Solution:

(I) Theoretical Future Price

Future Price = $S \times [1 + (r - d)t]$

$= 195 \left[1 + (0.095 - 0.03) \times \frac{91}{365}\right]$

= 1,214.37

Future Price = 1,214.37 × 100 = 1,21,437

Actual Future Price = 1,225 × 100 = 1,22,500

(i) Since actual future price is more than Theoretical Future Price hence future is overpriced.

(ii) Since future is overpriced, hence buy spot & sell future [short position]

(iii) - Borrow ₹ (1,195 × 100) @ 9.5% p.a. for 91 days & buy index

- Sell future (short position) at 1,225 × 100

After 91 Days

	1260	1175
Sell Index	(1,260 × 100) + 1,26,000	(1,175 × 100) + 1,17,500
Dividend Received $\left[1{,}195 \times 3\% \times \frac{91}{365}\right] \times 100$	+ 893.79	+ 893.79
Repayment $1{,}195 \left[1 + \left(0.095 \times \frac{91}{365}\right)\right] \times 100$	- 1,22,330.35	- 1,22,330.35
Gain/Loss on short position	(-35 × 100) = -3,500	(+50 × 100) = +5,000
Arbitrage	1,063.44	1,063.44

Question – 24

Suppose current price of an index is ₹ 13,800 and yield on index is 4.8% (p.a.). A 6 months future contract on index is trading at ₹ 14,340.

Assuming that risk free rate of interest is 12%. Show Mr. X (an arbitrageur) can earn an abnormal rate of return irrespective of outcome after 6 months . You can assume that after 6 months index closes at ₹ 10,200 and ₹ 15,600 and 50% of stock included in index shall pay dividend in next 6 months. Also Calculate implied risk free rate.

Solution:

Theoretical Future Price

F = 13,800(1.06)

= 13,800 × 50% × 4.8%

= 14,628 – 331.20

= 14,296.80

Since future is overpriced hence buy spot & sell future (short position)

After 6 Months **14340 ↓**

	10,200	15,600
Sell Index	+ 10,200	+ 15,600
Dividend	+ 331.20	+ 331.20
Buy Index (Spot)	- 13,800	- 13,800
Gain/Loss on Short Position	+ 4,140	- 1,260
Arbitrage Gain	871.20	871.20

Implied Risk Free Rate $= \frac{871.20}{13,800} \times 100 \times \frac{12}{6}$

= 12.63% p.a.

Note: जब भी Implied Risk Free Rate मांगेगा Borrowing नहीं लेना है।

Question – 25

A future contract is available on R Ltd. that pays an annual dividend of ₹4 and whose stock is currently priced at ₹125. Each future contract calls for delivery

of 1,000 shares to stock in one year, daily marking to market. The corporate treasury bill rate is 8%.

Required:

(i) Given the above information, what should the price of one future contract be?

(ii) If the company stock price decreases by 6%, what will be the price of one futures contract?

(iii) As a result of the company stock price decrease, will an investor that has a long position in one futures contract of R Ltd. realizes a gain or loss ? What will be the amount of his gain or loss?

(Ignore margin and taxation, if any)

(Exam Nov – 2019)

Solution:

(i) Price of one future contract

F = S (1 + r) – D

= ₹ 125 (1.08) – 4

= ₹ 131

= 131 × 1,000 shares

= ₹ 1,31,000

(ii) If stock price decrease by 6%

S = 125 × 0.94 = 117.50

F = 117.50 (1.08) – 4

= ₹ 122.90

= ₹ 122.90 × 1,000 shares

= ₹ 1,22,900

(iii) Gain or Loss on Long Position

If stock price decrease then loss on long position

(1,31,000 – 1,22,900) = 8,100 (Loss)

Question – 26

The price of ACC stock on 31 December 2010 was ₹ 220 and the futures price on the same stock on the same date, i.e., 31 December 2010 for March 2011 was ₹ 230. Other features of the contract and related information are as follows:

Time to expiration - 3 months (0.25 year)

Borrowing rate - 15% p.a.

Annual dividend on the stock - 25% payable before 31.03.2011

Face Value of the Stock - ₹ 10

i. Based on the above information, what should be the futures price?

ii. Show the process of arbitrage

Solution:

i. Futures price = 220 + (220 × 0.15 × 0.25) – (0.25 × 10) = 225.75

ii. He will buy the ACC stock at ₹ 220 by borrowing the amount @ 15 % for a period of 3 months and at the same time sell the March 2011 futures on ACC stock. By 31st March 2011, he will receive the dividend of ₹ 2.50 per share. On the expiry date of 31st March, he will deliver the ACC stock against the March futures contract sales.

The arbitrager's inflows/outflows are as follows:

Sale proceeds of March 2011 futures	₹ 230.00
Dividend	₹ 2.50
Total (A)	**₹ 232.50**
Pays back the Bank	₹ 220.00
Cost of borrowing	₹ 8.25
Total (B)	**₹ 228.25**
Balance (A) – (B)	**₹ 4.25**

Thus, the arbitrage earns ₹ 4.25 per share without involving any risk.