

Question Paper
Portfolio Management and Mutual Funds – I (251) : October 2005

Section A : Basic Concepts (30 Marks)

- • This section consists of questions with serial number 1 - 30.
- • Answer all questions.
- • Each question carries one mark.
- • Maximum time for answering Section A is 30 Minutes.

1. The market price of stock of PRG Enterprises is Rs.50 and the required rate of return on PRG's stock is 14%. The risk-free rate of return is 6% and the market risk premium is 8%. All other things remaining the same, what will be the market price of the security, if its covariance with the market portfolio doubles? (Assume that the stock is expected to pay a constant dividend in perpetuity)
- (a) Rs.50.00 (b) Rs.45.55 (c) Rs.40.45 (d) Rs.31.82 (e) Rs.25.50.
2. Successful portfolio managers generally work on which of the following strategies?
- I. Timing the market.
II. Selection of superior stocks or group of stocks.
III. Having a short-term investment strategy.
- (a) Only (I) above (b) Only (II) above
(c) Both (I) and (II) above (d) Both (II) and (III) above
(e) All (I), (II) and (III) above.
3. Sarvasanth Ltd. specializes in manufacturing sparkplugs. It is predominantly an asset rich firm. Due to rapid technological changes, some of its assets have experienced changes in their economic lives. The Sarvasanth Ltd. is said to have experienced
- (a) Financial risk (b) Liquidity risk (c) Investment risk
(d) Business risk (e) Credit risk.
4. PPF has been managing a portfolio of individuals and institutions. Mr. Avinash, the manager of the fund has framed identical policies for both the kinds of investors. His junior analyst contends that these two groups of investors are not alike in their preferences. Which of the following statements do(es) support the claim of the junior analyst?
- I. Individual investors are more technical in their risk perception than the institutional investors.
II. Investment policies of the institutions are determined by their choices and preferences.
III. Individual investors can be categorized based on their psychological characteristics.
- (a) Only (I) above (b) Only (II) above
(c) Only (III) above (d) Both (II) and (III) above
(e) All (I), (II) and (III) above.
5. Ramesh is more risk-averse than Celina. On a graph that shows Ramesh's and Celina's indifference curves, which of the following is/are **true**? Assume that the graph shows expected return on the vertical axis and standard deviation on the horizontal axis.
- I. Ramesh's indifference curves will have steeper slopes than Celina's.
II. Ramesh's indifference curves will have flatter slopes than Celina's.
III. Ramesh's indifference curves will be downward sloping and Celina's will be upward sloping.
- (a) Only (I) above (b) Only (II) above
(c) Only (III) above (d) Both (I) and (III) above

(e) Both (II) and (III) above.

6. A purely passive strategy is defined as

[< Answer >](#)

- I. One that uses only index funds.
- II. One that is mean-variance efficient.
- III. One that allocates assets in fixed proportions that do not vary with market conditions.

- (a) Only (I) above
- (b) Only (II) above
- (c) Only (III) above
- (d) Both (I) and (III) above
- (e) All (I), (II) and (III) above.

7. If a risk averse investor believes that the probability of the price of a stock moving up is higher than the probability of the price plummeting, he should

[< Answer >](#)

- (a) Buy an in-the money put and sell an in-the-money call
- (b) Buy an in-the-money call and sell an out-of-the-money put
- (c) Buy an in-the-money call and buy an out-of-the-money put
- (d) Sell an in-the-money call and buy an out-of-the-money put
- (e) Sell an out-of-the money call and buy an in-the-money put.

8. The intrinsic value of an out-of-the-money call option is

[< Answer >](#)

- (a) The Call Premium
- (b) The stock price minus the exercise price
- (c) Negative
- (d) The strike price
- (e) Zero.

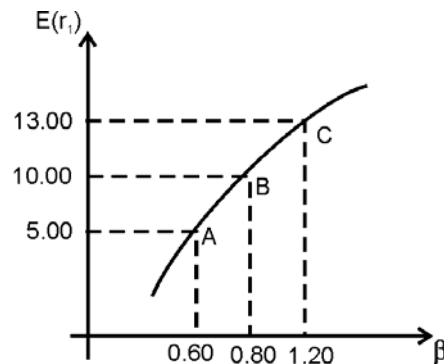
9. An investor wants to earn a return of 18% and is ready to undertake the risk corresponding to this level of expected return. The expected return on the market portfolio is 15% and the variance of returns on the market portfolio is $400 (\%)^2$. The risk-free rate of return is 7%. If the separation theorem holds good, what is the standard deviation of the returns for the portfolio constructed by the investor?

[< Answer >](#)

- (a) 13.32%
- (b) 15.81%
- (c) 27.50%
- (d) 177.42%
- (e) 756.25%.

10. Assume that one factor APT model depicts the expected return – beta relationship as shown in the figure given below for three stocks A, B and C:

[< Answer >](#)



Assuming that the prices of all the stocks are same, which of the following combination of stocks results into a zero beta portfolio with maximum return?

- (a) Buy 4 stocks of A and sell 3 stocks of B
- (b) Buy 3 stocks of B and sell 4 stocks of A
- (c) Buy 3 stocks of B and sell 2 stocks of C
- (d) Buy 2 stocks of C and sell 3 stocks of B
- (e) Buy 1 stock of C and sell 2 stocks of A.

11. Key motives for trading are value, information and cash flows. Which of the following statements is/are **true** with respect to these key motives?

[< Answer >](#)

- I. Value traders, by reducing the time of the trading, can reduce the cost of trading.
- II. Information traders tend to be more careful with respect to the time.

III. Cash-flow motives arise out of the need to increase or decrease the equity exposure.

- (a) Only (I) above
(b) Only (II) above
(c) Only (III) above
(d) Both (II) and (III) above
(e) All (I), (II) and (III) above.

12. Consider the following information about two stocks A & B:

[< Answer >](#)

Stock	Expected Return (%)	Beta (β)	Firm-Specific Standard Deviation (%)
A	13	0.8	30
B	18	1.2	40

If the market index has a standard deviation of returns of 22% and the risk-free rate is 5%, what are the standard deviations of returns on stocks A & B respectively?

- (a) 34.78% and 49.73%
(b) 47.93% and 54.62%
(c) 34.78% and 47.93%
(d) 34.78% and 51.17%
(e) 47.93% and 53.53%.

13. To an individual investor, the two **most** important factors in describing his/her investment objectives are

[< Answer >](#)

- (a) Return requirement and risk tolerance
(b) Income level and risk tolerance
(c) Age and return requirement
(d) Income level and tax rate
(e) Liquidity and tax rate.

14. Consider the single-index model. The alpha of a stock is 2%. The return on the market index is 16%. The risk-free rate of return is 5%. The stock earns a return that exceeds the risk-free rate by 13% and there are no firm-specific events affecting the stock performance. The beta of the stock is

[< Answer >](#)

- (a) 0.75
(b) 1.00
(c) 1.25
(d) 1.50
(e) 2.00.

15. A portfolio manager has collected information about the weights of the different categories of stocks in the market index and the sensitivity of returns on these categories of stocks to the three important factors as follows:

[< Answer >](#)

Category of Stocks	Weight in the Market Index	Factor I (Beta)	Factor II (Price/Book)	Factor III (Average Capitalization)
Small cap value	10%	0.90	0.75	1.25
Small cap growth	25%	0.80	1.39	1.35
Large cap value	15%	0.85	2.05	6.75
Large cap growth	50%	1.165	2.75	8.65
Market risk premium		6.85%	- 3.5%	0.65%

The risk free rate of return is 5%. What is the expected return on the market index, if the CAPM holds good?

- (a) 9.98%
(b) 10.32%
(c) 10.66%
(d) 11.85%
(e) 12.48%.

16. You are working as a portfolio manager of an asset management company that is considering to construct a portfolio with Rs.40 million. The portfolio is expected to provide the returns of Rs.15 million p.a for the next 10 years. The portfolio's beta is 2.2. Assuming that the return on treasury bills is 6.5% and expected return on market portfolio is 17%, what is the highest possible beta estimate for the portfolio before its ratio of present value of cash inflows to present value of cash outflows becomes less than one?

[< Answer >](#)

- (a) 2.62
(b) 2.88
(c) 2.29
(d) 2.79
(e) 3.09.

17. You know that firm Arvind Industries Ltd. is very inefficiently managed. On a scale of 1(best) to 10 (worst), you would give it a score of only 8. The market's consensus is that the management score is 6. Your decision should be [< Answer >](#)
- To hold the stock, as you strongly believe that the firm is not the worst
 - To sell the stock, as every one in the market believes the firm to be better than you believe
 - To buy the stock, as in your view, the firm is undervalued by the market
 - To hold the stock, till the conflict of ranking is resolved
 - To sell the stock, as in your view, the firm is overvalued by the market.
18. If coefficient of correlation of the returns between a portfolio and the market is 1, the Portfolio's [< Answer >](#)
- Net selectivity is zero.
 - Net selectivity will be equal to its total selectivity.
 - Unsystematic risk is zero.
 - Net selectivity will be equal to the return from inadequate diversification.
- Both (I) and (II) above
 - Both (II) and (III) above
 - Both (III) and (IV) above
 - (I), (II) and (III) above
 - (I), (III) and (IV) above.
19. An investor in the 25% tax bracket would be indifferent between a municipal bond with a yield of 5% and a corporate bond with a pre-tax yield of [< Answer >](#)
- 4.00%
 - 6.25%
 - 6.67%
 - 7.25%
 - 7.75%.
20. The rate of return on Treasury bills is 6% and the market rate of return is 13%. In addition, Santha Pharmaceuticals, which has an equity beta of 1.5, surprisingly just won a lawsuit that awards it Rs.6 lakh this year. If the market had expected Santha Pharmaceuticals to win Rs.3 lakh and the original value of it's equity is Rs.300 lakh, what could be the expected rate of return of it's stock this year? [< Answer >](#)
- 12.5%
 - 14.0%
 - 17.5%
 - 19.5%
 - 20.0%.
21. At the prevailing environment, [< Answer >](#)
- The CML equation for a portfolio i is given as
- $$E(r_i) = 6 + 1.26 \sigma_i$$
- The ex-ante SML equation for the same portfolio i is
- $$E(r_i) = 6 + 6.5 \beta_i$$
- Therefore, the variance of market portfolio is approximately
- $26.61(\%)^2$
 - $64.46(\%)^2$
 - $126.86(\%)^2$
 - $233.33(\%)^2$
 - Data insufficient.
22. Nifty futures with an expiry date of October 27, 2005 are presently quoted at Rs.2210 on October 3, 2005. Each contract is in multiple of 200. The daily volatility in the futures price is 3.33%. The initial margin calculated by VAR at a confidence level of 99% will be [< Answer >](#)
- Rs.5,655.6
 - Rs.7,579.8
 - Rs.11,310.6
 - Rs.16,965.8
 - Rs.44,155.8.
23. Mr. Rajesh is managing a portfolio of Rs.1,00,000 which includes a zero-coupon bond with maturity of 5 years and a perpetuity bond. Both the bonds are currently yielding 5% return. His present target duration is 10 years. By next year, if his target duration is 9 years, the changes in the proportion of investments made in zero-coupon bond and perpetual bond respectively are [< Answer >](#)
- Increases by 0.0125 and decreases by 0.0125
 - Decreases by 0.0250 and increases by 0.0250
 - Increases by 0.0184 and decreases by 0.0184
 - Decreases by 0.0125 and increases by 0.0125
 - Decreases by 0.0184 and increases by 0.0184.

24. Long-term treasury bonds currently are selling at yields to maturity of nearly 8%. Mr. Sukumar is expecting interest rates to fall. The rest of the market thinks that they will remain unchanged over the coming year. Which of the two bonds should Mr. Sukumar select? [< Answer >](#)

- (a) Baa- rated bond, since it has the higher yield to maturity and the longer duration
- (b) Aaa-rated bond, since it has the lower yield to maturity and the longer duration
- (c) Baa- rated bond, since it has the lower yield to maturity and the lower duration
- (d) Aaa-rated bond, since it has the higher yield to maturity and the longer duration
- (e) Baa-rated bond, since it has the lower yield to maturity and the longer duration.

25. As per Arbitrage Pricing Theory (APT), which is a multi factor model, the return on any asset i is given by [< Answer >](#)

$$R_i = \alpha_{i0} + \beta_{i1} I_1 + \beta_{i2} I_2 + \beta_{i3} I_3 + \dots + \beta_{im} I_m + e_i$$

where the notations are in their standard use.

If the variance $(R_i) = 360(\%)^2$ and the above equation explains 80% of the total variance, then the variance of error term i.e. $\text{Var}(e_i)$ will be

- (a) $0(\%)^2$
- (b) $72(\%)^2$
- (c) $100(\%)^2$
- (d) $150(\%)^2$
- (e) $160(\%)^2$.

26. Mr. Sen has a portfolio of 150 scrips. To use Markowitz model he must have [< Answer >](#)

- (a) 9888 estimates
- (b) 10925 estimates
- (c) 11475 estimates
- (d) 12950 estimates
- (e) 15850 estimates.

27. The data given below relates to the sensitivity of a stock based on the BIRR model. [< Answer >](#)

Risk Factor	Estimated Factor Sensitivity	Estimated Market price for Risk (%)
Confidence risk	0.65	2.89
Time horizon risk	0.76	3.24
Inflation risk	- 0.78	-
Business Cycle risk	- 2.65	0.95
Market Timing risk	1.75	2.45

If the risk-free rate is 4.95% and the expected return on the stock is 13.3%, the estimated market price for inflation risk is

- (a) 1.35%
- (b) -2.87%
- (c) -3.30%
- (d) +2.87%
- (e) +3.30%.

28. Under the optimization approach to the construction of a bond portfolio, the objective function can be [< Answer >](#)

- I. Maximization of yield.
- II. Maximization of duration.
- III. Maximization of expected total return.

- (a) Only (I) above
- (b) Only (II) above
- (c) Both (I) and (II) above
- (d) Both (I) and (III) above
- (e) All (I), (II) and (III) above.

29. Based on their relative degrees of risk tolerance [< Answer >](#)

- I. Investors will hold varying amounts of risky assets in their portfolios.
- II. Investors will hold varying amounts of risk free assets in their portfolios.
- III. All investors will have the same portfolio asset allocations.

- (a) Only (I) above
- (b) Only (II) above
- (c) Only (III) above
- (d) Both (I) and (II) above
- (e) Both (I) and (III) above.

30. The success of a cross-hedging between a corporate bond portfolio and a T-bond futures contract depends on [< Answer >](#)

- I. The correlation between the corporate bond portfolio and the T-bond futures price.
 - II. The duration of the corporate bond portfolio.
 - III. The relative pricing between the two.
- (a) Only (I) above
 - (b) Only (II) above
 - (c) Only (III) above
 - (d) Both (I) and (II) above
 - (e) All (I), (II) and (III) above.

END OF SECTION A

Section B : Problems (50 Marks)

This section consists of questions with serial number 1 – 5.

Answer **all** questions.

Marks are indicated against each question.

Detailed workings should form part of your answer.

Do not spend more than 110 - 120 minutes on Section B.

1. The following data is related to returns on three stocks and market index for a period of last 6 years:

Year	SAIL	Aventis Ltd.	Sterlite	Market Index
1	10%	4%	3%	5.0%
2	12%	7%	4%	6.0%
3	16%	19%	8%	7.5%
4	18%	13%	11%	10.2%
5	20%	29%	12%	13.0%
6	23%	35%	15%	17.0%

You are **required** to

- Construct a minimum risk portfolio of two stocks.
- Determine the coefficient of correlation of the portfolio with the market index, if a portfolio of all three stocks with equal proportion is constructed.

(8 + 4 = 12 marks) < Answer >

2. Mr. Pandu has collected the following information from the market with a view to constructing a portfolio.

The market return historically has shown a variance of $30\%^2$. He has zeroed in on the following stocks with the parameters given below:

Stock	Alpha (%)	Residual Variance $(\%)^2$	Return (%)
ACC	3.72	11.35	15.42
ICICI	0.60	12.92	13.21
Infosys	0.41	10.79	16.53
Nestle	(0.22)	7.36	13.30
Samsung	0.45	6.52	14.88

The risk free rate is 7% p.a. and market is expecting a premium of 6% p.a. over risk free rate.

You are **required** to construct an optimum portfolio using the Sharpe's optimization method.

(12 marks) < Answer >

3. As part of your analysis of debt issued by Sudarshan, you are asked to evaluate two specific bond issues, shown in the table below.

	Bond X (Callable)	Bond Y (Non-callable)
Maturity	2011	2011
Coupon	11.50%	7.25%
Current price	Rs.125.75	Rs.100.00
Yield to maturity	7.70%	7.25%
Modified duration to maturity	6.20 years	6.80 years
Call date	2006	-
Call price	Rs.105	-
Yield to call	5.10%	-
Modified duration to call	3.10	-

You are **required** to

- a. Compare the price and yield behavior of the two bonds under each of the following two scenarios, using the duration and yield information in the table.
 - i. Strong economic recovery with rising inflation expectations.
 - ii. Economic recession with reduced inflation expectations.
- b. Calculate the projected price change for bond Y, if the yield-to-maturity for this bond falls by 75 basis points, using the information in the table.
- c. Describe the shortcoming of analyzing bond X strictly to call or to maturity.

(4 + 1 + 4 = 9 marks) [< Answer >](#)

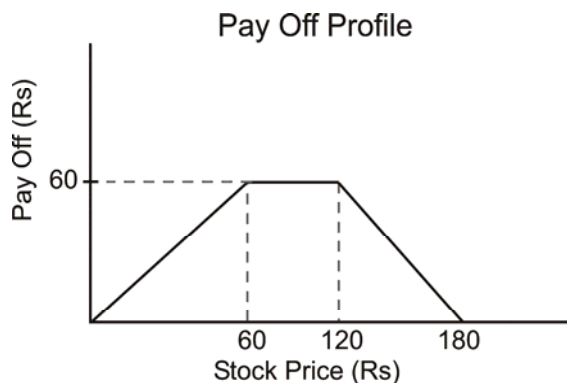
4. The 3-month futures on a stock index portfolio are trading at a price of 2190. The stock index currently is 2170 and the year-end dividend that is expected to be paid on Rs.2170 investment in the stock index portfolio is Rs.10. The yield on government securities is 6% p.a.

You are **required** to

- a. Determine by how much the contract is mispriced.
- b. Formulate a zero-net investment arbitrage portfolio and show that you can lock in risk less profits equal to the futures mispricing.
- c. Explain whether there is an arbitrage opportunity, if you short sell the stocks in the market index, the proceeds of the short sale are kept with the broker and you do not receive any interest income on the funds. (Assume that you don't already own the shares in the index).
- d. Determine the no-arbitrage band for the stock-futures price relationship, in a scenario like part (c).

(2 + 2 + 2 + 4 = 10 marks) [< Answer >](#)

5. Three calls with strike prices of Rs.60, Rs.120 and Rs.180 are available on a stock. Given below is the payoff diagram of a portfolio consisting of the call options and stock.



You are **required** to devise a portfolio using only call options and stock which gives the above pay off (Ignore premium on call options).

(7 marks) [< Answer >](#)

END OF SECTION B

Section C : Applied Theory (20 Marks)

This section consists of questions with serial number 6 - 7.

Answer **all** questions.
 Marks are indicated against each question.
 Do not spend more than 25 -30 minutes on section C.

6. Portfolio management decisions result in equity trading. Trading strategies are to be handled with care and it is different from portfolio management, in that the stocks selection does not need others' cooperation. Trading needs some counter party to trade with. Discuss the various steps involves in trading.

(10 marks) [< Answer >](#)

7. Indexing strategy is one form of passive management. Under this strategy, a bond portfolio is formed with the objective of replicating the performance of selected index. Explain the advantages and disadvantages of indexing strategy.

(10 marks) [< Answer >](#)

END OF SECTION C

END OF QUESTION PAPER

Suggested Answers

Portfolio Management and Mutual Funds-I (251): October 2005

Section A : Basic Concepts

1. Answer : [< TOP >](#)

Reason : If the covariance of the security doubles, its beta would also double. The current beta of the security is 1 so the new beta would be 2. The new required rate of return would be $6 + 2 \times 8 = 22\%$. Since, the stock is expected to pay dividend in perpetuity and the current market price is Rs.50, the expected dividend = $50 \times 0.14 = \text{Rs.}7.00$

At the new discount rate of 22%, the stock would be worth $7/0.22 = \text{Rs.}31.82$.

2. Answer : [< TOP >](#)

Reason : Successful portfolio managers work on timing the market, selection of superior stocks or group of stocks and having a long-term investment strategy. Hence (c) is the correct answer.

3. Answer : [< TOP >](#)

Reason : If some of its assets experience changes in their economic lives, the company faces business risk. Hence (d) is the correct answer.

4. Answer : [< TOP >](#)

Reason : Institutional investors are more technical in their risk perception than the

individual investors. Investment policies of the institutions are determined by the regulatory structure. Individual investors can be categorized based on their psychological characteristics. Hence option (c) is correct.

5. Answer : [< TOP >](#)

Reason : Since Ramesh is more risk-averse than Celina, Ramesh's indifference curves will be steeper than those of Celina, since he requires more return for even small increase in risk. Even though the degree of risk averse differs, both are risk averse and hence indifference curves of both will be upward sloping. Hence, alternative (a) is answer.

6. Answer : [< TOP >](#)

Reason : A purely passive strategy is defined as one that uses only index funds and that allocates assets in fixed proportions that do not vary with market conditions. Hence, both statements (I) and (III) are true. Therefore (d) is the correct answer.

7. Answer : [< TOP >](#)

Reason : If an investor believes that the probability of the price of a stock moving up is higher than the probability of the price plummeting, he should buy an in-the-money call and buy an out-of-the-money put. Hence, alternative (c) is answer.

8. Answer : [< TOP >](#)

Reason : The option premium can be broken down into two components - intrinsic value and time value. The intrinsic value of a call is $\text{Max}[0, (S_t - K)]$. Similarly, the intrinsic value of a put is $\text{Max}[0, (K - S_t)]$, where K is the strike price and S_t is the spot price. Options which are OTM and ATM have only time value and they do not have intrinsic value and hence, their intrinsic value is zero. Hence, alternative (e) is answer.

9. Answer : [< TOP >](#)

Reason : Consider the weight w_f towards lending at risk free interest rate r_f and the weight $(1 - w_f)$ towards investing the remaining fund in the market portfolio M.

Therefore,

$$\text{Expected portfolio return, } E(r_i) = w_f \times 7 + (1 - w_f) \times 15$$

$$\Rightarrow 18 = 7w_f + 15 - 15w_f$$

$$\Rightarrow 8w_f = -3$$

$$\Rightarrow w_f = -3/8 = -0.375$$

i.e., A should borrow 37.5% of the corpus at interest rate of 7% and invest the same in the market portfolio M to obtain the expected return of 18% from his investments.

$$\text{Standard Deviation of this portfolio, } \sigma_i = (1 - w_f) \times 20 = 1.375 \times 20 = 27.5\%.$$

10. Answer : [< TOP >](#)

Reason : Zero Beta portfolio can be formed as follows:

(i) Using stocks A and B

Buy 3 stocks of B and sell 4 stocks of A and vice versa

$$\begin{aligned}\text{Expected return 1} &= 3 \times 10 - 4 \times 5 \\ &= 30 - 20 = 10\%\end{aligned}$$

$$\text{Expected return 2} = -10\%$$

(ii) Using stocks B and C

Buy 2 stocks of C and sell 3 stocks of B and vice versa

$$\text{Expected return 1} = 26 - 30 = -4\%$$

$$\text{Expected return 2} = 4\%$$

(iii) Using stocks A and C

Buy 1 stock of C and sell two stocks of A and vice versa

$$\text{Expected return 1} = 13 - 2 \times 5.00 = 3\%$$

$$\text{Expected return 2} = -3\%$$

Clearly, buying 3 stocks of B and selling 4 stocks of A is giving the maximum return of 10%.

11. Answer: (d)

[<TOP>](#)

Reason: Value traders, by extending the time of the trading, can reduce the cost of trading; information traders tend to be more careful with respect to the time as information loses value with the passage of time. Cash-flow motives arise out of the need to increase or decrease the equity. Hence, statements (II) and (III) are true and alternative (d) is the correct answer.

12. Answer :

[<TOP>](#)

Reason : The standard deviation of each security is given by:

$$\begin{aligned}\sigma_i &= [\beta_i^2 \sigma_M^2 + \sigma^2(e_i)]^{1/2} \\ \sigma_A &= [0.8^2 \times 22^2 + 30^2]^{1/2} = 34.78\% \\ \sigma_B &= [1.2^2 \times 22^2 + 40^2]^{1/2} = 47.93\%.\end{aligned}$$

13. Answer :

[<TOP>](#)

Reason : To an individual investor, the two most important factors in describing his/her investment objectives are return requirement and risk tolerance. Hence (a) is the answer.

14. Answer :

[<TOP>](#)

Reason : The single index model can be represented as follows:

$$\text{Return on the stock} = \alpha + \beta R_m$$

The return on the market is 16% and return on the stock is $5\% + 13\% = 18\%$

Fitting these variables into the model, the beta of the stock is 1.00. Hence

(b) is the correct answer.

15. Answer :

[<TOP>](#)

Reason : Since, market beta is 1, expected return on the market index = $5\% + 6.85\% = 11.85\%$

Alternative method:

$$\text{Small cap value} = 5 + 6.85 \times 0.90 = 11.165\%$$

$$\text{Small cap growth} = 5 + 6.85 \times 0.80 = 10.48\%$$

Large cap value = $5 + 6.85 \times 0.85 = 10.8225\%$
 Large cap growth = $5 + 6.85 \times 1.165 = 12.98\%$
 Expected return on market index
 $= 0.10 \times 11.165 + 0.25 \times 10.48 + 0.15 \times 10.8225 + 0.50 \times 12.98 = 11.85\%$.

16. Answer :

[<TOP>](#)

Reason : The present value of cash flows is equal to initial cash outflows at YTM. Hence, YTM

$$40 = 15PVIFA(r\%, 10)$$

at $r = 32\%$

$$40 = 15 \times 2.9304 = 43.956$$

at $r = 36\%$

$$40 = 15 \times 2.6495 = 39.7425$$

By interpolation

$$= 32\% + [(43.956 - 40)/(43.956 - 39.7425)] \times 4\%$$

$$= 32\% + 3.755\% = 35.755\%.$$

The ratio of present value of cash inflows to present value of cash outflows becomes equal to one, when discount rate exceeds YTM. The highest value that beta can take before the discount rate exceeds YTM is

$$35.755\% = 6.5\% + \beta(17\% - 6.5\%)$$

$$29.255\% = 10.5\% \beta$$

$$= 2.7862 \approx 2.79.$$

17. Answer :

[<TOP>](#)

Reason : The decision should be to sell the stock. It is because, in your view, the firm is not so good as everyone else believes it to be. Therefore, you view the firm as overvalued by the market. You are more pessimistic about the firm's prospects than the beliefs built into the stock price. Hence, alternative (e) is answer.

18. Answer : (b)

[<TOP>](#)

Reason : If the coefficient of correlation of a portfolio with market index is 1 then its unsystematic risk is zero as $\text{unsystematic risk} = (1 - \rho^2)\sigma_i^2$. If unsystematic is Zero, then return due to total selectivity would be equal to its net selectivity and return from in adequate diversification is 0. Hence (II) and (III) are correct. Hence (b) is the answer.

19. Answer :

[<TOP>](#)

Reason : Let the before tax corporate bond yield be X. This X when multiplied by $(1 - 0.25)$ should yield 5%. Solving for X, we get 6.67%. Hence (c) is the answer.

20. Answer :

[<TOP>](#)

Reason : Based on the broad market trends, the CAPM suggests that Santha Pharmaceuticals stock should have the return of $6\% + 1.5(13\% - 6\%)$

=16.5%.

However, market had expected that the settlement would be for Rs.3 lakh, but the actual settlement was Rs.6 lakh which was more than expected and so the firm-specific return would be $((6-3)/300) = 0.01 = 1\%$ for a total return of $16.5\% + 1\% = 17.5\%$.

21. Answer : (a)

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Reason : Form of CML is $E(R_i) = R_f + \left(\frac{R_m - R_f}{\sigma_m} \right) \sigma_i$

& of ex-ante SML is $E(R_i) = R_f + (R_m - R_f) \beta_i$

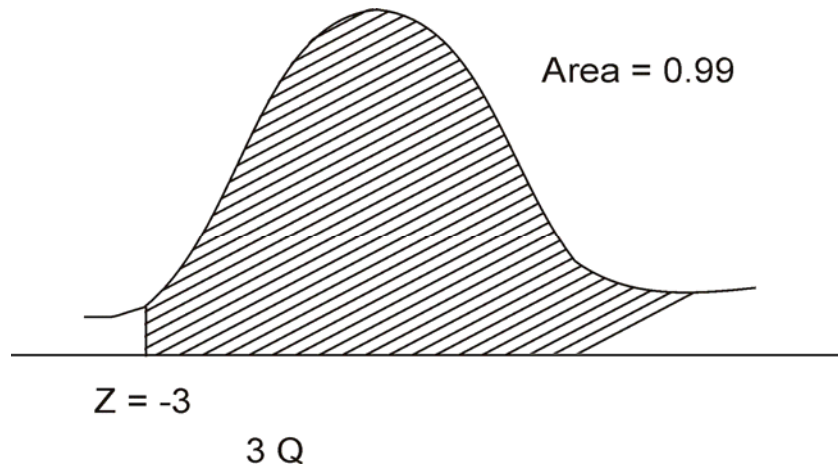
Therefore, $\frac{R_m - R_f}{\sigma_m} = 1.26$
 $(R_m - R_f) = 6.50$

From the above equations, $\sigma_m^2 = (6.5/1.26)^2 = 26.61$ i.e., $26.61(\%)^2$.

22. Answer : (e)

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Reason :



Hence, VAR at 99% confidence level $= 3\sigma$
 $= 3 \times 3.33 = 9.99\%$

and in Rupee terms VAR $= 2210 \times 200 \times \frac{9.99}{100}$
 $= 44155.8$

Therefore, the initial margin required = Rs. 44155.8.

23. Answer :

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Reason : The duration of the perpetuity $= 1.05/0.05 = 21$ years

Let W be the weight of the zero coupon bond.

Since present target duration is 10 years

$$W \times 5 + (1-W) \times 21 = 10$$

$$21 - 16W = 10$$

$$W = 11/16 = 0.6875$$

$$\text{Weight of perpetual bond} = 1-W = (1-0.6875) = 0.3125$$

Target duration after 1 year is 9 years

The duration of zero-coupon bond is 4 years

Since target duration is 9 years

$$W \times 4 + (1-W) \times 21 = 9$$

$$W = 12/17 = 0.7059$$

$$\text{Weight of perpetual bond} = 1-W = (1-0.7059) = 0.2941$$

$$\text{Change in the weight of zero coupon bond} = 0.7059 - 0.6875 = 0.0184$$

$$\text{Change in the weight of perpetual bond} = 0.2941 - 0.3125 = -0.0184$$

24. Answer :

[<TOP>](#)

Reason : To benefit from a rate decrease, Mr. Sukumar should select the longer-duration bond with lower yield to maturity. Since the Aaa-rated bond will have the lower yield to maturity and the longer duration, it should be selected.

25. Answer : (b)

[<TOP>](#)

Reason : Variance (r_i) = Variance explained by the factor model +
Unexplained variance i.e., variance of error term

$$360 = 0.8 \times 360 + \text{Var}(e_i)$$

$$\text{Var}(e_i) = 360 - 0.8 \times 360 = 72(\%)^2.$$

26. Answer : (c)

[<TOP>](#)

Reason : To use Markowitz framework of a portfolio of n scrips one needs n returns,

n variances and $\frac{n(n-1)}{2}$ unique covariance estimates, i.e., in all

$$\frac{n(n+3)}{2} = \frac{n^2 + 3n}{2} \text{ estimates Hence, required number of estimates} = \frac{150^2 + 3 \times 150}{2} = 11475.$$

27. Answer :

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Reason : Expected return as per BIRR model

$= \sum (\text{Estimated Factor sensitivity} \times \text{Estimated Market Price for risk}) + \text{Risk free rate}$

Using the given data, we get

$$\text{Expected return} = 0.65 \times 2.89 + 0.76 \times 3.24 + (0.78) \times \text{estimated market price for inflation risk} + (-2.65) \times 0.95 + 1.75 \times 2.45 + 4.95 = 13.30\%$$

$$\text{Estimated market price for inflation risk} = -2.87\%.$$

28. Answer : [<TOP>](#)

Reason : Under the optimization approach, the objective function can be (I) maximization of yield and (III) maximization of expected total return. Maximization of duration is not desirable as it increases the interest rate risk. Hence, alternative (d) is answer.

29. Answer : (d) [<TOP>](#)

Reason : Statement (III) is incorrect as degree of risk tolerance does affect the weightage of risk free assets and risky assets in their portfolios.

30. Answer : [<TOP>](#)

Reason : The success of a cross-hedging between a corporate bond portfolio and a T-bond futures contract depends on the correlation between the corporate bond portfolio and the T-bond futures price. Hence (a) is the correct answer.

Section B : Problems

1. a.

Year	R_s	R_a	R_{st}	R_m	$(R_s - \bar{R}_s)$ (a)	$(R_a - \bar{R}_a)$ (b)	$(R_{st} - \bar{R}_{st})$ (c)	$(R_m - \bar{R}_m)$ (d)
1	10	4	3	5	-6.5	-13.83	-5.83	-4.78
2	12	7	4	6	-4.5	-10.83	-4.83	-3.78
3	16	19	8	7.5	-0.5	1.17	-0.83	-2.28
4	18	13	11	10.2	1.5	-4.83	2.17	0.42
5	20	29	12	13	3.5	11.17	3.17	3.22
6	23	35	15	17	6.5	17.17	6.17	7.22
Σ	99	107	53	58.7				
Mean	16.5	17.83	8.83	9.78				

$(R_s - \bar{R}_s)^2$	$(R_a - \bar{R}_a)^2$	$(R_{st} - \bar{R}_{st})^2$	$(R_m - \bar{R}_m)^2$	a x d	b x d	c x d
42.25	191.27	33.99	22.85	31.07	66.11	27.87
20.25	117.29	23.33	14.29	17.01	40.94	18.30
0.25	1.3689	0.69	5.198	1.14	-2.668	1.892
2.25	23.329	4.71	0.176	0.63	-2.031	0.911
12.25	124.77	10.05	10.37	11.27	35.97	10.21
42.25	294.81	38.07	52.13	46.93	123.97	44.55
119.5	752.84	110.84	105.01	108.05	262.3	103.73

$$\bar{R}_s = \frac{99}{6} = 16.5$$

$$\sum (R_s - \bar{R}_s)^2 = 119.5$$

$$\sum (R_s - \bar{R}_s)(R_m - \bar{R}_m) = 108.05$$

$$\bar{R}_a = \frac{107}{6} = 17.83$$

$$\sum (R_a - \bar{R}_a)^2 = 752.84$$

$$\sum (R_a - \bar{R}_a)(R_m - \bar{R}_m) = 262.3$$

$$\bar{R}_{st} = \frac{53}{6} = 8.83$$

$$\sum (R_{st} - \bar{R}_{st})^2 = 110.84$$

$$\sum (R_{st} - \bar{R}_{st})(R_m - \bar{R}_m) = 103.73$$

$$\bar{R}_m = \frac{58.7}{6} = 9.78$$

$$\sum (R_m - \bar{R}_m)^2 = 105.01$$

$$\sigma_s = \sqrt{\frac{119.5}{5}} = 4.89$$

$$\sigma_m = \sqrt{\frac{105.01}{5}} = 4.58$$

$$\text{Cov}_{sm} = \frac{108.05}{5} = 21.61$$

$$\sigma_a = \sqrt{\frac{752.84}{5}} = 12.27 \quad \text{Cov}_{am} = \frac{262.3}{5} = 52.46$$

$$\sigma_{st} = \sqrt{\frac{110.84}{5}} = 4.71 \quad \text{Cov}_{stm} = \frac{103.73}{5} = 20.75$$

Beta of the stocks

$$\beta_s = \frac{21.61}{21} = 1.03$$

$$\beta_a = \frac{52.46}{21} = 2.5$$

$$\beta_{st} = \frac{20.75}{21} = 0.99$$

According to single index model covariance between two stock x and y can be calculated by the following formula:

$$\text{Cov}_{xy} = \beta_x \beta_y \sigma_m^2$$

$$\begin{aligned} \text{Cov}_{sa} &= \beta_s \beta_a \sigma_m^2 \\ &= 1.03 \times 2.5 \times 21 = 54.1(\%)^2 \end{aligned}$$

$$\begin{aligned} \text{Cov}_{sst} &= \beta_s \beta_{st} \sigma_m^2 \\ &= 1.03 \times 0.99 \times 21 = 21.41(\%)^2 \end{aligned}$$

$$\begin{aligned} \text{Cov}_{ast} &= \beta_a \beta_{st} \sigma_m^2 \\ &= 2.5 \times 0.99 \times 21 = 51.98(\%)^2 \end{aligned}$$

Correlation coefficient between stocks

$$\rho_{sa} = \frac{54.1}{4.89 \times 12.27} = 0.90$$

$$\rho_{sst} = \frac{21.41}{4.89 \times 4.71} = 0.93$$

$$\rho_{ast} = \frac{51.98}{12.27 \times 4.71} = 0.90$$

For min^m risk portfolio

$$\rho_{AB} < \frac{\sigma_A}{\sigma_B} \text{ where } \sigma_A < \sigma_B$$

$$\begin{aligned} \rho_{sa} &= 0.90 > \frac{4.89}{12.27} \\ &= 0.90 > 0.3985 \end{aligned}$$

$$\begin{aligned} \rho_{sst} &= 0.93 < \frac{4.71}{4.89} \\ &0.93 < 0.96 \end{aligned}$$

This satisfies the condition

$$\begin{aligned} \rho_{ast} &= 0.90 > \frac{4.71}{12.27} \\ &= 0.90 > 0.3839 \end{aligned}$$

Only combination of SAIL and Sterlite is fulfilling the criteria and minimum risk portfolio can be formed using these two stocks.

b. Portfolio beta

$$\beta_p = \frac{1.03 + 2.5 + 0.99}{3} = 1.51$$

Correlation of portfolio with respect to market index

$$\beta_p = \rho_p \frac{\sigma_p}{\sigma_m}$$

$$\rho_p = \frac{\beta_p \sigma_m}{\sigma_p} = \frac{1.51 \times 4.58}{\sigma_p}$$

Portfolio risk

$$\sigma_p^2 = \left(\frac{1}{3}\right)^2 \times (4.89)^2 + \left(\frac{1}{3}\right)^2 \times (12.27)^2 + \left(\frac{1}{3}\right)^2 \times (4.71)^2 + 2 \times \frac{1}{3} \times \frac{1}{3} \times 54.10 + 2 \times \frac{1}{3} \times \frac{1}{3} \times 21.41 + 2 \times \frac{1}{3} \times \frac{1}{3} \times 51.98$$

$$\sigma_p^2 = 2.66 + 16.73 + 2.46 + 12.02 + 4.76 + 11.55 = 50.18(\%)^2$$

$$\sigma_p = 7.084\%$$

Correlation of the portfolio

$$\rho_p = \frac{1.51 \times 4.58}{7.084} = 0.98$$

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2. The return on the market = 7 + 6 = 13%

The market variance = 30 (%)²

Stock	α_i	$\beta_i = (R_i - \alpha_i) / R_m$		$R_i - R_f$	$(R_i - R_f) / \beta_i$	Rank
ACC	3.72	0.90	11.35	8.42	9.36	1
ICICI	0.60	0.97	12.92	6.21	6.40	4
Infosys	0.41	1.24	10.79	9.53	7.69	2
Nestle	(0.22)	1.04	7.36	6.30	6.06	5
Samsung	0.45	1.11	6.52	7.88	7.10	3

Rank	Stock	σ_{ei}^2	β_i	$R_i - R_f$	$(R_i - R_f) \times \beta_i$	$(R_i - R_f) \beta_i / \sigma_{ei}^2$
1.	ACC	11.35	0.90	8.42	7.58	0.668
2	Infosys	10.79	1.24	9.53	11.82	1.095
3	Samsung	6.52	1.11	7.88	8.75	1.342
4	ICICI	12.92	0.97	6.21	6.02	0.466
5	Nestle	7.36	1.04	6.30	6.55	0.890

Stock	$\frac{(R_i - R_f) \beta_i}{\sigma_{ei}^2}$	$\frac{\beta_i^2}{\sigma_{ei}^2}$	$\frac{(R_i - R_f) \beta_i}{\sum \sigma_{ei}^2}$	$\frac{\beta_i^2}{\sum \sigma_{ei}^2}$	$C_i = \frac{\sigma_m^2 \sum \frac{(R_i - R_f) \beta_i}{\sigma_{ei}^2}}{1 + \sigma_m^2 \sum \frac{\beta_i^2}{\sigma_{ei}^2}}$
ACC	0.668	0.071	0.668	0.071	6.4026

Infosys	1.095	0.143	1.763	0.214	7.1280
Samsung	1.342	0.189	3.105	0.403	7.1161
ICICI	0.466	0.073	3.571	0.476	7.0111
Nestle	0.890	0.147	4.461	0.623	6.7969

$$C^* = 7.1280$$

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2} \left(\frac{R_i - R_f}{\beta_i} - C^* \right)$$

$$Z_{ACC} = \frac{0.9}{11.35} (9.355 - 7.128) = 0.1766$$

$$Z_{Infosys} = \frac{1.24}{10.79} (7.685 - 7.128) = 0.0640$$

$$\%_{ACC} = \frac{0.1766}{0.2406} = 0.7340 \text{ i.e. } 73.40\%$$

$$\%_{Infosys} = \frac{0.0640}{0.2406} = 0.2660 \text{ i.e., } 26.6\%$$

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3. a. **Scenario 1:** Strong economic recovery with rising inflationary expectations: Interest rates and bond yields will most likely rise and the prices of both bonds will fall. When interest rates rise, the probability that the callable bond will be called declines, and it will behave more like the non-callable bond—notice that they have similar durations when priced to maturity. The slightly lower duration of the callable bond will result in somewhat better performance in the high interest rate scenario.

Scenario 2: Economic recession with reduced inflation expectations: Interest rates and bond yields will most likely fall. The callable bond is likely to be called. The relevant duration calculation for the callable bond is now modified duration to call. Price appreciation is limited as indicated by the lower duration. The non-callable bond, on the other hand, continues to have the same modified duration and hence has greater price appreciation.

- b. b. If yield to maturity (YTM) on Bond Y falls by 75 basis points:

Projected price change = (modified duration) × (change in YTM)

$$= (-6.80) \times (-0.75\%) = 5.1\%$$

So, the price will rise to Rs.105.10 from its current level of Rs.100.

- c. c. For Bond X (the callable bond) bond life and therefore bond cash flows are uncertain. If one ignores the call feature and analyzes the bond on a “to maturity” basis, all calculations for yield and duration are distorted. Durations are too long and yields are too high.

On the other hand, if one treats the premium bond selling above the call price on a “to call” basis, the duration is unrealistically short and yields are too low. The most effective approach is to use an option evaluation approach. The callable bond can be decomposed into two separate securities: a non-callable bond and an option. As the issuer can use his call option at any time, the risk associated with callable bond is more for the investors, and hence he gives less value to the bond to the extent of price of option. It can be mathematically expressed as

Price of callable bond = Price of non-callable bond - Price of option.

Since the option to call the bond will always have some positive value, the callable bond will always have a price, which is less than the price of the non-callable security.

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4. a. From parity, $F_0 = 2170 \times (1 + 0.06/4) - 10 = 2192.55$

Actual $F_0 = 2190$

So, the futures are under-priced by 2.55

- b. b. Buy the relatively cheap futures and sell the relatively expensive stock.

	Present Cash Flows (Rs.)	Cash Flows in 3 months (Rs.)
Sell Shares	+ 2170	$-(S_T + 10)$
Buy Futures	0	$S_T - 2190$
Lend Rs.2170 @ 6% p.a	- 2170	+ 2202.55
Total	0	2.55

- c. c. If you do not receive interest on the proceeds of the short sales, the Rs.2170 you receive will not be invested but will simply be returned to you. The proceeds from the strategy in part (b) are now negative: an arbitrage opportunity no longer exists.

Sell Shares	+ 2170	$-(S_T + 10)$
Buy Futures	0	$S_T - 2190$
Place Rs.2170 in margin account	- 2170	+ 2170
Total	0	- 30

- d. d. If we call the original futures price F_0 , the proceeds from the long-futures, short-stock strategy are

Sell shares	+ 2170	$-(S_T + 10)$
Buy futures	0	$S_T - F_0$
Place Rs.2170 in margin account	- 2170	+ 2170
Total	0	$2060 - F_0$

Therefore, F_0 can be as low as 2060 without giving rise to an arbitrage opportunity. On the other hand, if F_0 is higher than the parity value, 2192.55, an arbitrage opportunity (buy stock, sell futures) will open up. There is no short-selling cost in this case. Therefore, the no-arbitrage band is $2060 \leq F_0 \leq 2192.55$.

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5. a. To give the required pay off depicted in figure, the portfolio strategy should be
1. Buy a stock

2. Write call with strike price Rs.60
3. Write call with strike price Rs.120
4. Buy call with strike price Rs.180

The following table gives an idea about what will be the pay off under different underlying stock prices.

	$S_T < 60$	$60 < S_T < 120$	$120 < S_T < 180$	$S_T > 180$
Buy a stock	S_T	S_T	S_T	S_T
Write call ($x = 60$)	0	$-(S_T - 60)$	$-(S_T - 60)$	$-(S_T - 60)$
Write call ($x = 120$)	0	0	$-(S_T - 120)$	$-(S_T - 120)$
Buy call ($x = 180$)	0	0	0	$(S_T - 180)$
	S_T	60	$180 - S_T$	0

This definitely represents the pay off depicted in the figure.

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Section C: Applied Theory

6. Trading involves the following steps:

- • Finding the motivation to trade
- • Predicting market conditions and stock's liquidity
- • Establishing trading strategies
- • Trade information
- • Flexibility
- • Appraise effectiveness when the trading is complete

Trade Motivation: According to Jack Treynor, key motives for trading are value, information and cash flow. Value trades are rarely timely i.e., only on a few occasions. The value traders can use time according to their convenience so that by extending the time of trading, they can reduce the cost of trading. Thus, they are less sensitive to time, compared to price. As information is liable to be spread across the market rapidly, it loses value soon. Hence, information traders tend to be more sensitive to time. On the other hand, the cash flow motive arises out of the need to increase or decrease the equity exposure. The objective of the traders is to recognize which motivation applies to each trade and to select the appropriate trading strategy.

Asset market conditions: Once the trade motivation is known, it is necessary to determine the expected cost of liquidity for the appropriate size. In this respect, the volume of stock trading is also important. Further, it is also important to note that besides volume, the frequency of trading is also vital. Markets may be dominated by buyers or sellers depending on the supply and demand of the stocks. A trader needs to assess the market conditions by analyzing the display of bids and offers either on the exchange or on the various proprietary trading and information networks.

Establishing initial trading strategies: A trading strategy can either involve a broker or slow accumulation of stocks without any broker intervention. But both of them have downside risk,

such as

- • The liquidity cost of the stocks, and
- • The trader risking his share to move against him before the order is executed.

Trading information: A proper trade can take place only when a buyer and a seller can agree on a common price. The seller may be a broker, who is willing to sell the shares for a fee or he may even be a direct seller. For the buyer, his first job is to assess the liquidity of the stock. On the availability of liquidity, with time on his side, he looks for his favorite stocks. Here, we can see that while value motivated stocks are to be traded slowly, same trade in an illiquid stock might result in competition once the information is available in the market.

Flexibility: The chose strategy must be flexible enough to be corrected in between, if there are any changes in the market. Thus, the trader must possess various skills in order to adapt himself to the various market conditions.

Assess Effectiveness: The market is constantly changing. As liquidity demands change, volume of trades also changes. So, every completed trade provides a unique feedback to the trader, who realizes the need for adapting to both changing demands and market conditions.

Some of the commonly followed trading recommendations.

- • **One trading strategy does not fill all:** It should be remembered that trading strategies have to be chosen depending on the situations. There is no single strategy, which is ideal for all situations.
- • **Prioritize and make contingency plans:** It is not good practice to look for only minimum cost trades or wait for better markets since this would lead to increased competition and loss of liquidity.
- • **Build expected costs into portfolio decision-making:** The portfolio manager's job is to pick on the right kind of value. In other words, that stocks whose costs are less than returns. But the critical problem lies in determining time at which the costs exceed returns. If the manager is well informed about the expected exist cost, he would be able to make better decisions.
- • **Rationalize broker use:** This is similar to the concept of business,, where the vendor is dependent on the businessmen and not the other way. Similarly, if the trader trades with several brokers, he can quickly realize the difference between each of them and apply his skills to select the best.

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7. One of the primary factors driving bond portfolio managers towards indexing is the unimpressive performance of the active management strategies. Poor and inconsistent performance of the active bond portfolio managers in the past has turned the investors to index funds. In the past, returns earned by most active fund managers could match or outperform the market indices; their performance was not consistent over a period of time. Therefore, the investors naturally turned to index funds where they could obtain consistently higher long-term returns and reliable short-term performance.

Another factor driving interest in index funds is the lower advisory fee schedule. Compared with active fund management, advisory fee schedule is very attractive for indexed funds. In the USA, advisory fees for index funds range between 30 and 70 percent of advisory fees for actively managed funds. This leads to substantial lower

advisory fee schedule; transaction costs will also be lower for the index funds. This is because of lower turnover of assets and hence fewer transaction in the portfolio.

Another advantage of indexing is the degree of control exercised by the investor. Under active management, the investor has little control over the fund manager's investment decisions at any point of time. By indexing, the investor can specify the benchmark as well as the degree of latitude allowed to the index fund manager to deviate from the benchmark characteristics. For example, an active fund manager can change the duration of the portfolio to any extent depending on his interest rate forecast, but index fund manager may be constrained by, say, a maximum deviation of 10 per cent from the duration of the index. Thus, the investor can have a greater degree of control over investment under indexing strategy.

Indexing facilitates easier and better measurement of performance of the fund manager. Performance of a fund manager is measure by comparing the total return of the portfolio with the total return of the benchmark. Most widely used benchmarks are broad market indexes. Such comparison under active investment management has two serious shortcomings. The selected index may not be the appropriate benchmark for the fund manager. Secondly, deviations of portfolio characteristics from the benchmark characteristics, which explain the relative performance, are not thoroughly examined. These shortcomings can be overcome by indexing. Extensive search for the appropriate index must precede establishing the index fund, which ensures identification of an appropriate performance benchmark. Secondly, index fund investors can focus on the deviation of return of the portfolio from that of benchmarked index and require fund managers to attribute these deviations to specific benchmark characteristics.

Although indexing has many advantages over active management of portfolio, it has some disadvantages also. One of the main disadvantages of indexing is the loss of incremental returns, which could have been generated by investing in sectors with the highest performance. By not investing in better performing sectors and securities, the opportunity cost can be substantial. Different sectors and different types of securities like treasuries, corporate bond, mortgage-backed securities, etc., can generate incremental returns for the portfolio.

Another limitation of index funds is the rigid requirements associated with these funds. There may be attractive opportunities for investment outside the benchmark universe. If the fund manager is not allowed to invest in securities outside the universe of the benchmark index, then some attractive investment opportunities may be foregone.

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