Birla Institute of Technology & Science, Pilani.
Hyderabad Campus, First Term 2022-23
Course No. ECON F412/FINF313   Course Title: Security Analysis & Portfolio Management
Comprehensive Examination, Marks: 80 (20+60) (40%) Date/Venue/Time: 17/12, AN

Instructions: Use of calculators are allowed. This is an OPEN-book examination. Please write with a blue pen. Answers are to be presented in the required format wherever mentioned to be considered for evaluation. There are a total of 5 questions (including cross-word)

PART – B (60 MARKS)

QUESTION – II (5 X 4 MARKS = 20 MARKS)

Q 2.1) Suppose there are 2 risky stocks, A and B. Stock A has an expected return of 4% and a standard deviation of return of 5%. The corresponding statistics for Stock B are 11% and 9%, respectively. The correlation coefficient between the returns of stocks A and B is -ve0.5. An investor wants to achieve a standard deviation of 7% in his portfolio. What is the optimal portfolio (proportion invested in assets) for the investor and what is the expected return of this portfolio? There are no restrictions in the market. Solve with steps and answer in your answer sheet as the format given below.

W_A (% upto 2 decimal)	W_B (% upto 2 decimal)	$E(R_p)$ (% upto 2 decimal)

Q 2.2) Assume two stocks have the following characteristics: -

	Expected Return	Standard deviation
C	16%	8%
S	9%	5%

The coefficient of correlation between the returns of the two stocks is 0.

What is the % investment in the two stocks in order to have a minimum variance portfolio? Short selling is allowed. What is the standard deviation achieved for the MVP? Solve with steps and answer in your answer sheet as the format given below. There are no restrictions in the market.

W_C (% upto 2 decimal)	W_S (% upto 2 decimal)	sigma(R_p) (% upto 2 decimal)

Q 2.3) The investor wants to allocate funds to Stock fund, Bond fund and some cash (*cash can be considered to be risk free asset*). Following are the expected return and risk of the various assets.

Assets	Expected return	Standard deviation of returns
Stock fund	16%	22%
Risk free rate	8%	
Bond fund	10%	12%

The Investor's Utility function is

U = E(Rp) – 0.5 A *(Variance of returns of portfolio)

Where A is the coefficient of Risk aversion. A = 3.

E(Rp) is expected return of the portfolio. Correlation of returns between Stock fund and bond fund is 0.20. What is the optimal tangent portfolio by maximizing Sharpe ratio? How much will be the asset allocation in cash after maximizing utility? There are no restrictions in the market.

Solve with steps and answer as the format given below, in your <u>answer sheet</u>. % with 2 decimal

W stock (tangent portfolio)	W bond (tangent portfolio)	W cash (final solution)

Q 2.4) Consider the following performance data for fund A and a common benchmark portfolio

	Benchmark		Fund A	
	Weight	Return	Weight	Return
Stock	0.7	4%	0.5	8%
Bonds	0.2	3.50%	0.3	5.00%
Cash	0.1	0.30%	0.2	0.30%

Calculate the returns generated due to the selection effect and allocation effect for Fund A. Format below

Selection Effect (%) upto 2 decimal	Allocation Effect (%) upto 2 decimal

Q 2.5) You are trying to analyse the performance of the actively managed fund. You have the following information about the fund, market index and treasury security.

	Returns	Stdev of returns	beta
Fund	32.00%	16%	1.5
Market index	17.00%	14%	
90-day Treasury-bill	6.00%	0.00%	

You gathered more insights into the fund and found that fund was not fully diversified. The manager had included certain securities which they expected to be real winners, but that led to a compromise on the diversification. Do you think their selection of winners was justified? Answer by calculating the alpha i.e. returns over and above a required return due to a relevant measure of risk when the fund is not fully diversified. Solve with steps and answer as the format given below, in your answer sheet.

Alpha %	Justified/Not justified

QUESTION – III (10 MARKS)

You are hired as a fixed income portfolio manager. You have information about corporate bonds which are issued recently in the market. There is a green bond which is issued to fund projects with positive environmental benefits. The bonds issued were AAA-rated bonds. The par value of the bond is ₹1000. The characteristics of the bond are provided below: -

Bond	Time to maturity	Coupon rate p.a.	Payments
Green bond (G)	3 years	8%	Semi-Annual

The market interest rate (yield to maturity) is 9% p.a. for **Green bonds** at the time of issuance. You plan to invest in the bond.
The expected inflation is expected to rise and market interest rates are expected to rise by 350 basis points.

Q3.1 (2 marks) Calculate Annual Modified Duration and annual Convexity for the Green bond.

Q3.2 (2 marks) Calculate the % change in price with the adjustments of relevant measures for the Green bond for 350 basis points increase in market interest rates.

Q3.3 (2 marks) Draw a graph showing the relationship of Bond price with Bond yield and the relevant measures. Show the underestimation and overestimation of prices due to the slope measure and the required adjustment needed for the same in the same graph.

Q3.4 (4 marks) An insurance company wishes to shield its overall financial obligation from exposure to interest rate fluctuations. They wanted to fund the obligation using 2-year zero coupon bond (20% proportion investment for immunization), perpetual bond paying annual coupons (ytm being 9% p.a.) and the Green bond as in the Table above. The insurance company has an expected obligation of $24000 in 7 years. What should the proportion invested in Green bond and Perpetual bond be to shield their obligation from market interest rate fluctuations? Note use annual Macaulay duration of Green bond for calculation.

QUESTION – IV (10 MARKS)

You are trying to analyze the performance of the actively managed fund. You have the following information about the fund. The fund comprises stocks, bonds and some cash holdings. The Tables below provide information on the market value of these asset classes in the fund, the correlation of returns between asset classes, and their expected returns and standard deviation of returns. All values are annualized values. The correlation of returns of these asset classes with the market index (which is the benchmark index) is also provided.
The expected return of the market index was 8% p.a. and the standard deviation of returns of the market index was 24% p.a.

Asset classes in Fund	Invested Market value (INR million)	Expected Return (%)	Standard deviation of returns (%)
Stock	1500	18%	25%
Bond	800	9%	12%
Cash	600	6%	0%

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Correlation matrix	Stock	Bond	Cash	Market
Stock	1	-ve 0.3	0	0.8
Bond	-ve 0.3	1	0	0.2
Cash	0	0	1	0
Market	0.8	0.2	0	1

Q4.1 (3 marks) Calculate the expected return and standard deviation of the fund's return.

Q4.2 (4 marks) Calculate the beta of stock, bond and cash and present it in 3x1 matrix form.

Calculate the beta of the fund.

Q4.3 (3 mark) Calculate the Jensen alpha for the fund if the relevant risk measure is just systematic risk (i.e. calculate returns over and above a required return due to systematic risk)

Question V (20 MARKS)

You are working as an intern at *XYZ Hedge fund,* and your task is to deliver a 20% return with minimum risk. You have done some thorough research on equity-linked funds and have suggested an overall investment plan that allocates the assets across three broad classes to achieve diversification. There is short selling allowed in the market.
1. A Digital fund (DF)
2. A Venture advisor fund (VA)
3. A Pharma fund (PF)

You wanted to calculate the estimates of portfolio inputs to the optimization problem using a Fama-French 3-factor model. You calculated the estimates by running a multivariate regression.

$$Ri = \alpha i + \beta i1\,(Rm - Rf) + \beta i2\,SMB + \beta i3\,HML + ei$$

Where Ri returns to asset i, αi is the intercept term in the equation for asset i, βiz is sensitivity of return to asset i to factors, ei is error term

The **monthly return** (i.e. premiums) related to risk factors such as *Market risk premium* was 0.5%. The monthly returns associated with SMB and HML were calculated from Table 5.1
Table 5.1: Returns information

Returns	Value stocks	Neutral stocks	Growth stocks
Small size	0.8%	0.6%	0.4%
Big size	0.3%	0.5%	0.5%

The monthly standard deviation of returns for *Market risk premium* was 1.5%, *SMB* was 1.2%, and *HML* was 1%. All factor returns and factor standard deviation are **monthly** rates.
The factor *correlation coefficients are provided in Table 5.2*

Correlation	Market risk premium	SMB	HML
Market risk premium	1	-ve0.2	-ve0.5
SMB	-ve0.2	1	0.6
HML	-ve0.5	0.6	1

Note: -ve means negative

Following are the results of the regression performed. The **monthly** returns of the fund (dependent variable; Ri) were regressed against the **monthly** returns of the three factors
$$Ri = \alpha i + \beta i1 * (Rm - Rf) + \beta i2\,SMB + \beta i3\,HML + ei$$
The estimates of α's, β's and error variance for all three funds are provided in Table 5.3 from the regression output ran with monthly returns.

Table 5.3: Regression Output (All significant)

Funds (i)	α_i	β_i1	β_i2	β_i3	error variance$_i$
DF	0.2%	0.8	-ve0.5	0.2	0.1%
VA	1.8%	0.3	0.2	0.4	0.04%
PF	0.6%	0.3	0.4	0.2	0.01%

All **annualized values** to be calculated as APR monthly compounding

Q5.1 *(4 marks)* Calculate the **annualized return** for all three funds and write as a 3x1 matrix. Answers in % till 2 decimal places.

Q5.2 *(4 marks)* Calculate the **annualized** standard deviation of returns for all three funds as 3x1 matrix. Answers in % expressed in 2 decimal places.

Q5.3 *(4 marks + 3 marks + 1 marks)* Calculate the **annualized covariance** and **correlation coefficients** for the **three funds** and present it as 3x3 matrix of variance-covariance matrix and correlation matrix. Comment on the correlation values. Covariances expressed as % with 2 decimal places, and correlation expressed as decimals 2 digit.

Q5.4 (*4 marks*) How will you solve the asset allocation problem? Write your portfolio optimization method equations (objective function) and constraints as matrix equations wherever possible.