

B.Tech IV Year II Semester (R09) Regular Examinations, March/April 2013

PRODUCTION & OPERATIONS MANAGEMENT

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions.
All questions carry equal marks.

- 1 (a) What are the production/operations management problems and key decision in day today operations in an organization?
- (b) What is difference between the effectiveness and efficiency?
- 2 (a) Define sales forecasting. Explain its importance.
- (b) Find the MAD (Mean Absolute Deviation) and MSE (Mean Square Error) for the following forecast:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Actual Demand	97	93	110	98	130	133	129	138	136	124	139	125
Forecasted Demand	100	100	100	100	102	104	106	108	110	112	114	116

- 3 (a) What is plant layout? Discuss objective and advantages of good plant layout.
- (b) Write notes on various computerized technique used in designing plant layout.
- 4 (a) What do you understand by aggregate plan?
- (b) Describe the relevant cost component involved in aggregate planning decision.
- 5 (a) What is safety stock? Why it is needed? Explain with suitable example.
- (b) An electrical housing has an annual usage rate of 75,000 unit/year, an ordering cost Rs.800 and annual carrying charge of 15.4% of the unit price. Delivery lead time is 2 weeks. Determine the optimal operating doctrine (Assume the cost of one unit is Rs.2)
- 6 (a) Find the sequence for the following 8 jobs that minimizes the total elapse time for the completion of all jobs. Each job is processed in the order CAB. Find the total elapsed time and idle time of each machine.

Machine Jobs	1	2	3	4	5	6	7	8
A	4	6	7	4	5	3	6	2
B	8	10	7	8	11	8	9	13
C	5	6	2	3	4	9	15	11

- (b) Distinguish between the Gantt chart and Gantt load chart.
- 7 (a) What are the inputs to material requirement planning?
- (b) What are the objectives of MRP?
- 8 Describe the lean management and philosophy to create a lean enterprise.

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- 1 (a) Explain in detail on concept of production vs productivity.
 (b) Describe the term productivity, and how it is used to measure in goods/service industry with suitable examples.
- 2 (a) State the objective of:
 (i) Short term forecasting.
 (ii) Long term forecasting.
 (b) What is meant by mean absolute deviation? What is its significance?
 (c) State general principals of forecasting.
- 3 (a) What are the principles for planning the layout of a new factory?
 (b) List and brief on different mathematical model used for facilities layout.
- 4 (a) Describe the single stage aggregate planning decision structure. State the decision process used for aggregate planning.
 (b) What is MRP? What is its purpose?
- 5 (a) What is economic order quantity? Derive the formula for determining EOQ.
 (b) Write in brief on ABC and VED selective inventory control techniques.
- 6 (a) Describe the factors affecting the scheduling.
 (b) A company has an order for five jobs ABCD & E that must be processed sequentially through two work centers backing and decoration. The time in hours is required for the jobs are shown below. Determine the schedule of sequence that minimize the total lapse time for the five jobs and present it in the form of Gantt chart.

Work centers	Time required jobs (Hrs)				
	A	B	C	D	E
Banking	5	4	8	7	6
Decoration	3	9	2	4	6

- 7 (a) Discuss various methods of line balancing.
 (b) What is ERP? What are its main features?
 (c) Write short notes on the following:
 (i) JIT Production. (ii) MRP II.
- 8 (a) Describe approach you would take to achieve the six sigma quality in an organization.
 (b) What do you know about Mumbai dabba wala and their six sigma approach?

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Answer any FIVE questions.
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- 1 (a) What is production function? Explain it with hypothetical example.
(b) Write notes on factor productivity index.
- 2 (a) State the advantage and limitation of sales forecasting.
(b) Using exponential smoothing techniques, compute the forecast from the following data (time series) under the situation when ($\alpha = 0.3$) compute the forecast for the 11th period.

Month	1	2	3	4	5	6	7	8	9	10
Demand	10	12	8	11	9	10	15	14	16	15

- 3 (a) Explain various factors that are considered before layout of a plant.
(b) Write short notes with proper diagram on group layouts and process layouts.
- 4 (a) Explain expediting.
(b) What single criteria priority decision rule might you expect to find an use with regards to the hospital emergency room?
- 5 (a) Describe the cost associated with the inventories.
(b) The Mahavir paints limited would like to improve the inventory management policies for its supply of paints used for automobiles. Annual demand for such paint is 50000 liters and paint cost Rs.20/ltr. Annual carrying cost is estimated at 15% of the price of paint held. Each order cost Rs.80/- Determine
(i) How much of the paint should be ordered each time?
(ii) How often should the paint be ordered?
(iii) What is total inventory cost?
- 6 (a) What are the objectives of scheduling?
(b) Explain the terms forward scheduling and backward scheduling.
- 7 A toy manufacturing company intends to produce 10,000 pieces of a particular toy per year. It has identified 10 work elements with the following precedence restriction and duration.
- | Elements | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----------------------|---|---|---|---|---|---|---|---|-----|----|
| Immediate precedence | - | 1 | 2 | 3 | 4 | 4 | 6 | 5 | 7,8 | 9 |
| Duration C Minutes | 5 | 8 | 3 | 2 | 5 | 5 | 8 | 2 | 3 | 6 |
- (a) Draw a precedence diagram for the assembly of toys.
(b) Design an assembly line for the cycle time of 13 minutes.
(c) Calculate the following
(i) Line efficiency. (ii) Balance delay. (iii) Smoothness index.
- 8 (a) State Deming's 14 principles on total quality management.
(b) Elaborate your approach on TQM implementation in an organization.

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(Mechanical Engineering)

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- 1 (a) What factors do you consider during the selection of new products? Explain them appropriately.
(b) Brief on the issues encountered during the product design.
- 2 (a) Describe exponential smoothing method of sales forecasting. State its advantage and limitation.
(b) Find the trend using the least square method for the data given below

Year	1975	1976	1977	1978	1979	1980	1981
Demand	85	75	80	72	65	60	55

- 3 (a) Distinguish between the product layout and process layout. Under what conditions each type layout is appropriate.
(b) Write notes on symptoms of poor layout.
(c) Brief on various tools of layout engineering.
- 4 Describe aggregate planning with suitable diagram and explain pure strategies of aggregate planning.
- 5 (a) Enumerate the various types of inventory models.
(b) What factor do you consider in fixing the maximum and minimum stock level?
- 6 (a) Describe:
(i) Master scheduling. (ii) Production scheduling.
(b) Draw a schedule chart and a load chart for the following data

Job	Time in Hrs on Machine	
	X	Y
A	2	4
B	5	2
C	1	3

Give order of the machine is first on X and then on Y.

- 7 (a) Difference between the line of balance and line balance.
(b) Define and explain:
(i) Work element. (ii) Work station. (iii) Total work content. (iv) Station time.
(v) Cycle time. (vi) Balance delay. (vii) Line efficiency. (viii) Smoothness index.
(ix) Station idle time. (x) Precedence diagram.
- 8 (a) Define the JIT production. State the pre-requisite to achieve JIT production.
(b) State merit and demerit of JIT production.

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B.Tech IV Year II Semester (R09) Regular Examinations, March/April 2013

ENERGY SYSTEMS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions.
All questions carry equal marks.

- 1 (a) What is extra terrestrial radiation?
(b) With a neat diagram explain the working of sunshine recorder.
- 2 Why orientation is needed in concentrating type collectors? Describe the different methods of sun tracking.
- 3 (a) Describe in briefly, the different energy storage methods used in the solar system.
(b) What are the applications of a solar pond?
- 4 Discuss the advantages and disadvantages of horizontal and vertical axis wind mill. What methods are used to overcome the fluctuatiy power generation of wind mill?
- 5 (a) How are Gasifiers classified?
(b) What are the techniques suggested for maintaining the biogas production?
- 6 Draw a neat sketch of possible electricity generation system cycle for geothermal energy conversion and describe them.
- 7 (a) Explain the closed cycle OTEC system with a neat sketch.
(b) What are the difficulties in tidal power developments?
- 8 What are the different types of MHD power cycles? Explain any one of them.

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ENERGY SYSTEMS
(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions.
All questions carry equal marks.

- 1 Classify different solar energy measuring equipments. What is the difference between a pyr heliometer and a pyranometer?
- 2 (a) With a neat sketch, explain the suitability of solar drier for food grains.
(b) Write short notes on solar pond.
- 3 (a) With the help of a neat sketch, describe a solar heating system using water heating solar collectors.
(b) Write short notes on solar distillation.
- 4 (a) Describe horizontal axis type aerogenerators.
(b) Describe the main considerations in selecting a site for wind generators.
- 5 What is meant by anaerobic digestion? What are the factors which affect biodigestion?
- 6 Describe the main types of turbines in brief, which may be used for geothermal energy conversion.
- 7 (a) What is the basic principle of ocean thermal energy conversion?
(b) What are the advantages of small scale hydroelectric power generation?
- 8 Write short notes on:
 - (a) Thermoelectric effects.
 - (b) Selection of thermoelectric materials.
 - (c) Fuel cells.

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ENERGY SYSTEMS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions.
All questions carry equal marks.

- 1 (a) How solar radiation is measured?
(b) What is meant by renewable energy sources? Explain in brief these energy sources with special reference to Indian context.
- 2 Enumerate the different types of concentrating type collectors. Describe a collector used in power plant for generation of electrical energy.
- 3 (a) What is the principle of solar photovoltaic power generation?
(b) What are the advantages and disadvantages of photovoltaic solar energy conversion?
- 4 What are the advantages of vertical axis machines over horizontal type? Describe a rotor for relatively low velocity wind.
- 5 (a) Differentiate between wet fermentation and dry fermentation.
(b) How bio-mass conversion takes place?
- 6 (a) Define a geothermal source.
(b) What are the possible sources of geothermal pollution? How these are avoided?
- 7 Describe the different types of turbines used for small scale hydroelectric plants.
- 8 (a) Explain the principle of working of thermo-electric generator.
(b) What are the various losses associated with operation of MHD generator.

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B.Tech IV Year II Semester (R09) Regular Examinations, March/April 2013

ENERGY SYSTEMS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

- 1 (a) What are the reasons for variation in solar radiation reaching the earth than received at the outside of the atmosphere?
(b) What are the advantages and limitations of renewable energy sources?
- 2 (a) What is the principle of conversion of solar energy into heat?
(b) What are the main components of a flat plate solar collector, explain the function of each?
- 3 Describe the layout and working of a continuous solar cooling system. What are its advantages?
- 4 (a) Derive an expression for power developed due to wind.
(b) Describe with a neat sketch the working of a wind energy system.
- 5 Explain the constructional details and working of KVIC digester with the help of a neat diagram. Write the applications of biogas.
- 6 (a) Give a brief note on prospects of geothermal energy in context to India.
(b) What are the applications of geothermal energy?
- 7 Explain with sketches the various methods of tidal power generation. What are the limitations of each method?
- 8 (a) Why Carnot cycle is not applicable in the estimation of efficiency of thermoelectric generator?
(b) Explain Seebeck, Peltier and Thomson effects.

B. Tech IV Year II Semester (R09) Regular Examinations, March/April 2013

GAS TURBINES & JET PROPULSION

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

- 1 (a) Derive the expression for specific work output and the efficiency of a simple cycle. Draw their trends as a function of pressure ratio.
- (b) In a gas turbine the pressure ratio to which air at 15°C is compressed is 6. The same air is then heated to a maximum permissible temperature of 750°C . First in a heat exchanger and then combustion chamber. It is then expanded in two stages such that the expansion work is maximum. The air is heated to 750°C after the first stage. Determine the cycle thermal efficiency, the work ratio and net shaft work per Kg of air.
- 2 (a) What are the various assumptions made in practical cycle analysis?
- (b) In a gas turbine the compressor taken in air at a temperature of 27°C and compresses it to five times the initial pressure with an isentropic efficiency of 85%. The air is then passed through a regenerator heated by the turbine exhaust before reaching the combustion chamber. The effectiveness of the regenerator is 80%. The maximum temperature after constant pressure combustion is 677°C and the efficiency of the turbine is 80%. Neglecting all losses except mentioned and assuming the working fluid throughout the cycle to have the characteristics of air,
 - (i) Sketch the cycle on the T-S diagram
 - (ii) Calculate the efficiency of the cycle
- 3 (a) What is meant by jet propulsion? What are the basic differences between jet propulsion cycle and shaft power cycle?
- (b) Explain the principle of jet propulsion and mention how the jet propulsion engines are classified.
- 4 (a) With the aid of the schematic diagram and thermodynamic cycle, explain the working of a turbo prop engine.
- (b) Mention the various advantages and disadvantages of a turbo prop engine and also bring out the applications.
- 5 (a) With the aid of a neat diagram, explain the working principle of a ramjet engine.
- (b) What are the advantages and disadvantages of a ramjet engine and what are its applications?
- 6 (a) How rockets are classified? What is the stage of development of each type?
- (b) Briefly describe the two types of solid propellant rockets.
- 7 (a) Explain the different types of injectors used in rocket technology.
- (b) What are applications of rocket technology?
- 8 Write a short notes on:
 - (a) Plasma arc propulsion
 - (b) Advanced propulsion systems
 - (c) Testing and instrumentation

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GAS TURBINES & JET PROPULSION
(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

- 1 (a) Draw the schematic diagram of a simple cycle and explain briefly the working of the cycle. Draw the P-V and T-S diagrams of the cycle.
(b) A gas turbine plant operates between 5°C and 839°C .
Find :
 - (i) Pressure ratio at which cycle efficiency equals Carnot cycle efficiency
 - (ii) Pressure ratio at which maximum work is obtained
 - (iii) Efficiency under conditions giving maximum work
- 2 For a gas turbine operating at a pressure ratio of 8.7 the maximum temperature ratio to be maintained such that the turbine just supports the compressor, which is given by $t_{\min} = 3.0$. If the compressor inlet total temperature and the turbine efficiency are respectively 300 K and 0.75.
Find :
 - (i) The compressor efficiency
 - (ii) The temperature ratio at which the compressor work is 80% of the power produced by turbine. Also find the corresponding heat addition and network output per unit mass flow in the gas turbine. Take $C_{P_a} = 1.147 \text{ KJ/Kg K}$.
- 3 (a) Explain the need for thermal jet engines and applications.
(b) Explain the classification of energy flow.
- 4 (a) With a neat sketch and T-S diagram, explain the working of turbo jet engine and also derive the expression for thrust developed.
(b) Explain with suitable graphs the performance of a turbo jet engine. What are the advantages and disadvantages of turbojet engine?
- 5 (a) Draw the thermodynamic cycle of the ramjet and derive the equation for thrust.
(b) Mention the various advantages and disadvantages of the pulse jet engine.
- 6 (a) What are the desirable requirements of a liquid propellant for rockets?
(b) Compare the advantages and disadvantages of solid and liquid propellants.
- 7 (a) What do you understand by staging of rockets?
(b) What is a need for feed systems in rocket technology?
- 8 (a) What is a need for cryogenics?
(b) What are the applications of cryogenics?

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GAS TURBINES & JET PROPULSION
(Mechanical Engineering)

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- 1 (a) Explain the important observations from the specific work output and efficiency variation as a function of pressure ratio for the simple cycle with reheat and heat exchange.
(b) A gas turbine unit operates at a mass flow of 30 Kg/s. Air enters the compressor at a pressure of 1 bar and temperature 15⁰C and is discharged from the compressor at a pressure of 10.5 bars. Combustion occurs at constant pressure and results in a temperature rise of 420 K. If the flow leaves the turbine at a pressure of 1.2 bars, determine the net power output from the unit and also the thermal efficiency. Take $C_p = 1.005 \text{ KJ/Kg K}$ and $\gamma = 1.4$.
- 2 The following data refer to a closed cycle gas turbine plant using helium as working fluid and incorporating two stage compression with inter-cooling and two stage expansion with reheating; temperature at entry to each compression stage is 270⁰C. Pressure at entry to first compression stage and exit from the second turbine stage is 1bar; first compression stage pressure ratio is 6, each compressor stage isentropic efficiency is 0.85; temperature at inlet to each expansion stage is 1150⁰C; isentropic efficiency of each expansion stage is 0.9; reheat pressure is 6 bar; for helium polytropic index n is 1.24 and R is 10.05 KJ/Kg K. Calculate the cycle thermal efficiency.
- 3 (a) Derive the expression for thrust, thrust power and propulsion efficiency of jet propulsion engine.
(b) Explain historical sketch of jet propulsion engine.
- 4 (a) What is meant by thrust augmentation and explain how it is affected?
(b) Explain the principle of after burner in thrust augmentation.
- 5 (a) With the aid of a schematic diagram, explain the working principle of pulse jet engine and also draw the ideal and actual P-V diagram.
(b) Explain the plant layout of ramjet engine.
- 6 (a) Draw a schematic diagram of a solid propellant rocket and explain its working.
(b) What are the applications of this type of rocket?
- 7 (a) Explain different types expansion nozzles used in rocket technology.
(b) What are the advantages and disadvantages of rocket technology?
- 8 (a) What do you understand by elementary treatment of electrical nuclear?
(b) What are the advantages and disadvantages of plasma arc propulsion?

B. Tech IV Year II Semester (R09) Regular Examinations, March/April 2013

GAS TURBINES & JET PROPULSION

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

- 1 (a) Draw the schematic diagram of a simple cycle with intercooler and explain briefly the working principle. Draw also the P-V and T-S diagrams of the cycle.
- (b) In a gas turbine plant, air enters the compressor at 1 bar and 27⁰C. The pressure ratio is 6. The temperature at turbine inlet is 1000 K. The mass flow rate of air is 10 Kg/s. Determine:
 - (i) Power required to drive the compressor and the turbine power output
 - (ii) The ratio of the turbine to compressor work
 - (iii) The net power developed by the plant and
 - (iv) The thermal efficiency

- 2 In the gas turbine plant shown, each compressor operates on a pressure ratio of 3 and an isentropic efficiency of 82%. After the low pressure compressor, sum of the air is extracted and passed to a combustion chamber from which the products leave at a temperature of 650⁰C and expand in power turbine. The remainder of the air passes through the high pressure compressor and into a combustion chamber from which it leaves at a temperature of 540⁰C and expands in a turbine which drives both the compressors. The isentropic efficiency of each turbine is 87%. If the temperature of the air at inlet to the low pressure compressor is 15⁰C. Determine the percentage of total air intake that passes to the power turbine and the thermal efficiency of the plant. For compression assume $C_p = 1.005 \text{ KJ/Kg K}$ and $\gamma = 1.4$
For heating and expansion $C_p = 1.147 \text{ KJ/Kg K}$ and $\gamma = 1.33$

- 3 (a) What are the essential features of propulsion devices?
- (b) What do you understand by thermal jet engines?

- 4 (a) Explain the working of a turbo jet engine.
- (b) What are the advantages and disadvantages of a turbo prop engine and also list out the applications.

- 5 (a) What are the basic characteristics of the ram jet engine?
- (b) Explain the working principle of a serqu jet with a neat sketch.

- 6 (a) What is the basic difference between rocket propulsion and jet propulsion? Can rockets work in vacuum?
- (b) Explain the basic principle of operation in rocket engines.

- 7 (a) What do you understand by flight mechanics?
- (b) Write a short notes on rocket transfer and ablative cooling.

- 8 (a) What is testing and instrumentation? And explain the significance of testing and instrumentation.
- (b) What are the applications of plasma arc propulsion?

Code: 9A03807

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B.Tech IV Year II Semester (R09) Regular Examinations, March/April 2013

COMPOSITE MATERIALS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions.
All questions carry equal marks.

- 1 Discuss the classification of composite materials. Give examples for each class.
- 2 Discuss about the various reinforcements used in composites. What are the advantages of ceramics over metal as fibers?
- 3 Discuss about the following:
 - (a) Metal matrix composites.
 - (b) Polymer matrix composites.
- 4 Explain about Poltrusion method and draw neat schematic diagram.
- 5 What is Tsai-Wu theory? Explain about the theory.
- 6 Discuss about the Hygrothermal stress-strain relationship for a unidirectional lamina.
- 7 Explain about in-plane and flexural modules of laminate.
- 8 What are the various design issues in mechanical design of laminates?

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COMPOSITE MATERIALS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions.
All questions carry equal marks.

- 1 "Composite materials are most suitable materials for aerospace and automobile industries". Explain the statement giving examples.
- 2 Discuss about the composition, advantages and salient features of metal matrix composites.
- 3 Write short notes on the following:
 - (a) Kevlar.
 - (b) Particular composites.
- 4 Explain the filament winding method for manufacturing composites with neat diagram.
- 5 Derive an equation for Hooke's law for two dimensional lamina.
- 6 Explain about Tsai failure theory.
- 7 Discuss about the following:
 - (a) Semi-empirical models.
 - (b) Halpin-Tsai equation.
- 8 Explain the phenomenon of warpage of laminate.

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COMPOSITE MATERIALS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions.
All questions carry equal marks.

- 1 How the composite are classified? Discuss about the various types with respect to advantages and applications.
- 2 Distinguish and discuss about the fiber reinforced composites and nature made composites.
- 3 Explain the following:
 - (a) Fiber glass.
 - (b) Kevlar.
 - (c) Carbon fibres.
- 4 Explain about the autoclave method of manufacturing composites.
- 5 Define the following material properties and mention independent elastic constants, (a) Anisotropic (b) Mono clinic (c) Transversely isotropic.
- 6 Discuss about Hooke's law for a two-dimensional angle lamina.
- 7 Consider a composite consists of fiber and matrix find (a) volume fractions (b) mass-fractions. Assume V_f , V_m , V_f , V_m , W_f and W_m have their usual meaning.
- 8 Explain about stress-strain relationship for a laminate.

Code: 9A03807

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B.Tech IV Year II Semester (R09) Regular Examinations, March/April 2013

COMPOSITE MATERIALS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions.
All questions carry equal marks.

- 1 Discuss the role of composite materials in present-day automobile and aerospace industries. Explain with suitable examples.
- 2 Explain the composition, advantages and salient features of fiber reinforced composites.
- 3 Explain the following:
 - (a) Particulate composite.
 - (b) Polymer composite.
- 4 Explain the compression moulding methods with neat diagrams.
- 5 Explain the relationship of compliance and stiffness matrix to engineering constants of a lamina.
- 6 Write short notes on the following:
 - (a) Failure envelope.
 - (b) Strain failure theory.
- 7 Discuss about Hygrothermal effects in a laminate.
- 8 Explain the failure criteria for a laminate.
