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10ME71

Seventh Semester B.E. Degree Examination, June/July 2015

Engineering Economy

Time: 3 hrs.

Max. Marks:100

**Note: 1. Answer any FIVE full questions, selecting atleast TWO questions from each part.
2. Use of discrete interest factors table is permitted.**

PART - A

- 1 a. Explain the role of an Engineer and challenges with respect to Economics. (06 Marks)
- b. Explain the concept of law of demand and supply. (04 Marks)
- c. List the six compound interest factors and their relationship. (06 Marks)
- d. A person takes a loan of Rs 12000 from a bank at an interest rate of 18% per annum. Find the amount if the interest is compounded.
 - i) Annually ii) Half yearly iii) Quarterly iv) Monthly. (04 Marks)
- 2 a. What is the significance of cash flow diagram? Sketch CFD for i) Borrower's viewpoint ii) Lender's viewpoint. (06 Marks)
- b. The following alternatives are available to accomplish an objective of 12 years duration :

	Plan A	Plan B	Plan C
Life cycle	6 years	3 years	4 years
First cost	Rs 2000	Rs 8000	Rs 10,000
Annual cost	Rs 3,200	Rs 700	Rs 500

- c. Compare the present worth of the alternatives using an interest rate of 7%. (08 Marks)
- c. Explain two prominent methods used for comparison of assets that have unequal lives. (06 Marks)
- 3 a. Define the following terms :
 - i) Service life ii) Accounting life iii) Economic life. (06 Marks)
- b. Two models of small machines perform the same function. Type I machine has a low initial cost of Rs 9500, relatively high operating costs of Rs 1900 per year more than those of the type II machine, and a short life of 4 years. The more expensive Type II machine costs Rs 25,100 and can be kept in service economically for 8 years. The scrap value from either machine at the end of its life will barely cover its removal cost. Which is preferred when the minimum attractive rate of return is 8 percent? (06 Marks)
- c. A person wants to buy a home theatre system. He estimates that it will last at least for 10 years at the end of which it will not have any salvage value. Show room offers him two alternative ways to pay for the system.
 - i) Pay Rs 1,00,000 immediately and Rs 50,000 at the end of one year.
 - ii) Pay nothing until the end of three years and make a single payment of Rs 2,00,000.
 If the buyer believes 12% is a suitable rate of interest which alternative is best? (08 Marks)
- 4 a. A company is in the process of selecting the best alternative among the following three mutually exclusive alternatives. Find the best alternative based on rate of return (calculation) comparisons. (08 Marks)

Alternative	Initial Investment	Annual Revenue	Life in years
A ₁	Rs 50,00,000	Rs 10,00,000	10 years
A ₂	Rs 80,00,000	Rs 14,00,000	10 years
A ₃	Rs 40,00,000	Rs 8,25,000	10 years

- b. A machine is purchased for Rs 8000 and the assumed life is 10 years and scrap value of Rs 2000. If the depreciation is charged by diminishing balance method, calculate the percentage by which value of machine is reducing every year and depreciation fund after 2 years. (06 Marks)

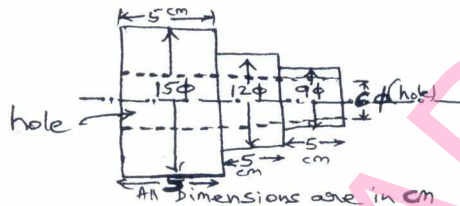
Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- c. Classify the various types of taxes. (06 Marks)

PART - B

- 5 a. Distinguish between the concept of estimating and costing. (05 Marks)
 b. With the help of examples, explain the various elements of costs. (05 Marks)
 c. A factory produces 6000 spark plugs per day involving a direct material cost of Rs 5,00,000. Direct labour cost of Rs 4,00,000 and factory overheads of Rs 1,50,000. Assume a profit of 20% of selling price and selling overheads are 30% of factory cost. Calculate the selling price of each sparkplug. (05 Marks)
 d. A cast iron cone pulley is shown in fig. Q5(d). Taking density of cast iron as 7.0208gm/cc. Calculate unit weight of component. What is cost of material, if cost per kg is Rs 15. (05 Marks)

Fig.Q5(d)



- 6 a. Explain the significance of finance functions. (06 Marks)
 b. Explain the salient features of : i) Profit and Loss account ii) Balance sheet. (06 Marks)
 c. Prepare a Balance sheet for the given data : (08 Marks)

Dividend payable	Rs 72,000	Debtors	Rs 1,60,000
Bank balance	Rs 10,000	Bills payable	Rs 20,000
Equity shares	Rs 2,00,000	Plant & Equipment	Rs 80,000
Provision for taxes	Rs 40,000	Bills receivable	Rs 20,000
Stock	Rs 77,000	Creditors	Rs 55,000
8% preference shares	Rs 1,35,000	General reserves	Rs 40,000
Land & building	Rs 2,00,000	Cash in hand	Rs 15,000

- 7 a. Explain the significance and limitations of financial ratio analysis (08 Marks)
 b. Write a note on Evaluation of a firm's earning power. (04 Marks)
 c. Classify the various financial ratios and their application. (08 Marks)
- 8 a. List the problems and dangers of budgeting. (06 Marks)
 b. Write a note on Bench Marking of manufacturing. (04 Marks)
 c. Draw a flexible budget for the overhead expenses on the following data : Determine the overhead rate at 70%, 80% and 90% plant capacity. (10 Marks)

Particulars	Plant capacity (80%)
<u>Variable overheads</u>	
Indirect labour	Rs 1,25,000
Spare parts	Rs 45,000
<u>Semi variable overheads</u>	
Power (50% fixed)	Rs 2,25,000
Repairs and maintenance (60% fixed)	Rs 20,000
<u>Fixed overheads</u>	
Depreciation	Rs 1,20,000
Insurance	Rs 35,000
Salaries	Rs 1,25,000
Estimated labour hours	1,60,000 hours

Seventh Semester B.E. Degree Examination, June/July 2015
Mechanical Vibrations

Time: 3 hrs.

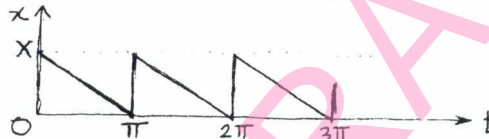
Max. Marks:100

**Note: Answer any FIVE full questions, selecting
atleast TWO questions from each part.**

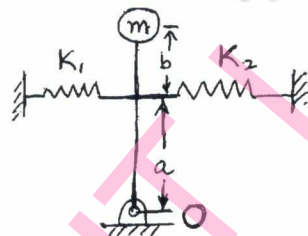
PART – A

- 1 a. Define the terms 'Periodic motion', 'Resonance', 'Degree of Freedom' and 'Phase difference'. (04 Marks)
- b. The motion of a particle is given by $x = 2 \sin\left(\omega t + \frac{\pi}{6}\right)$. This motion is due to two components and one of this is $\sin\left(\omega t - \frac{\pi}{3}\right)$. Find the other component analytically and verify the same graphically. (08 Marks)
- c. Represent the periodic motion shown in Fig.Q.1(c) by harmonic series. (08 Marks)

Fig.Q.1(c)



- 2 a. Obtain differential equation of motion for the system shown in Fig.Q.2(a) for small amplitude of vibration. Also determine: i) Natural frequency and ii) The value of 'a' for which the system will not vibrate. (10 Marks)



Rod is stiff of negligible mass

Fig.Q.2(a)

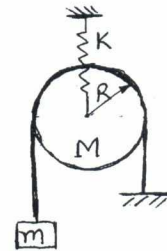
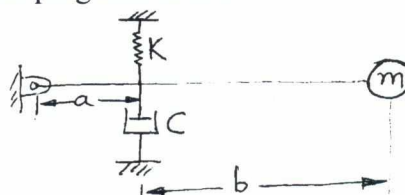


Fig.Q.2(b)

- b. Obtain differential equation of motion for the system of single degree of freedom shown in Fig.Q.2(b). The cord is inextensible and does not slip with pulley. (10 Marks)
- 3 a. State the types of damping and explain in brief 'Viscous damping'. (06 Marks)
- b. A spring-mass-dashpot system has, mass = 10kg and stiffness = 40 N/m. If the amplitude of free vibration decreases to 25% of original value after 5 cycles, determine the damping coefficient. (06 Marks)
- c. For the system of single degree of freedom shown in Fig.Q.3(c), obtain
 - i) differential equation of motion and
 - ii) expression for critical damping coefficient. (08 Marks)

Fig.Q.3(c)



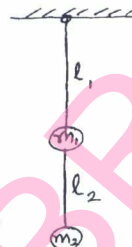
Rod is stiff and of negligible mass

- 4 a. Define 'Force Transmissibility' and obtain expression for
 i) Force transmissibility and
 ii) Phase lag of transmitted force with impressed force. (10 Marks)
- b. A machine of mass 100kg operating at 600rpm has a rotating unbalance of 100 kg-mm. The machine is mounted on springs having stiffness 85 kN/m and negligible damping. The system is constrained to move vertically.
 i) Determine the steady state amplitude.
 ii) If the damping is introduced to reduce the amplitude by 50%, what should be the damping coefficient? Also find damping factor. (10 Marks)

PART – B

- 5 a. Explain in brief 'seismic instrument' with a neat sketch. (05 Marks)
 b. Write a brief note on 'Frahm's Reed Tachometer'. (05 Marks)
 c. A rotor of mass 10kg is mounted on a 20mm diameter shaft supported at the ends by two bearings. Rotor is mounted in the middle of span of 500mm. The centre of gravity of rotor is 0.03mm away from the geometric centre. If the system rotates at 2500 rpm, find the amplitude of steady state vibrations and dynamic force on bearings, neglecting damping and mass of shaft ($E = 200 \text{ GPa}$). (10 Marks)
- 6 Obtain the differential equations of motion for the double pendulum shown in Fig.Q.6.

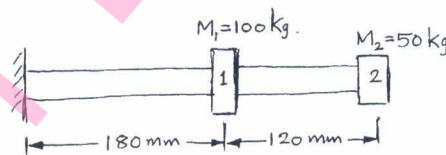
Fig.Q.6



If $m_1 = m_2 = m$ and $l_1 = l_2 = l$. Find: i) Natural frequencies; ii) ratio of amplitudes and draw mode shapes. (20 Marks)

- 7 a. Find the fundamental natural frequency of transverse vibration for the system shown in Fig.Q.7(a) by Dunkerle's method. (08 Marks)

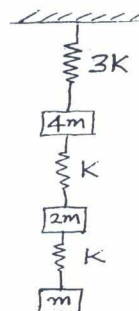
Fig.Q.7(a)



$$I = 4 \times 10^{-7} \text{ m}^4 \text{ and } E = 1.96 \times 10^{11} \frac{\text{N}}{\text{m}^2}$$

- b. Find the fundamental natural frequency for the system shown in Fig.Q.7(b) by the method of matrix iteration. (12 Marks)

Fig.Q.7(b)



- 8 a. Explain in brief the hardware of an equipment necessary for experimental modal analysis. (12 Marks)
 b. State the various types of machine maintenance techniques. Explain in brief. (08 Marks)

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10ME73

Seventh Semester B.E. Degree Examination, June/July 2015
Hydraulics and Pneumatics

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

PART - A

- 1
 - a. What are the advantages, limitations and applications of hydraulic systems? (06 Marks)
 - b. With a neat sketch, explain construction and working of unbalanced type gear pump and derive expression for volumetric displacement of the pump. (09 Marks)
 - c. Define the terms volumetric displacement, theoretical flow rate, volumetric efficiency and mechanical efficiency. (05 Marks)
- 2
 - a. Distinguish clearly between 1st class, 2nd class and 3rd class lever system used in hydraulic system. (09 Marks)
 - b. With a neat sketch, explain the working of axial piston motor. (05 Marks)
 - c. A hydraulic motor has 82cm³ (0.082L) volumetric displacements. If it has pressure rating of 70 bar and it receives oil from 0.0006m³/sec (0.60LPS) theoretical flow rate pump. Find the motor i) Speed ii) Theoretical torque iii) Theoretical power. (06 Marks)
- 3
 - a. With a neat sketch, explain the three types of center flow path configuration for Three positions, Four way valves. (09 Marks)
 - b. With a schematic diagram, explain the working of simple pressure relief valve. (05 Marks)
 - c. Explain the working of sequence valve with an example. (06 Marks)
- 4
 - a. Explain with suitable circuit how Automatic cylinder reciprocates with two sequence valves. (10 Marks)
 - b. Explain with Hydraulic circuit, how speed control can be achieved in Hydraulic motor. (06 Marks)
 - c. Explain spring loaded type accumulator used in Hydraulic system. (04 Marks)

PART - B

- 5
 - a. Give three important functions of Baffle plates used in reservoir. (07 Marks)
 - b. Define the terms Beta ratio and Beta efficiency of filters. (07 Marks)
 - c. Name five things that can cause a noisy pump. (06 Marks)
- 6
 - a. Explain the characteristics of compressed air. (05 Marks)
 - b. Sketch and explain the working of rodless cylinder. (05 Marks)
 - c. Explain briefly the end position cushioning of pneumatic cylinder. (10 Marks)
- 7
 - a. Write a note on direct and indirect actuation of pneumatic cylinders. (10 Marks)
 - b. Explain the logic OR function with a shuttle valve and the double acting cylinder. (10 Marks)
- 8
 - a. Explain the Motion control diagram for a 2 – cylinder circuit. (08 Marks)
 - b. Write a note on relays used in electro – pneumatic control. (06 Marks)
 - c. Sketch and explain the non receiving type pressure regulator. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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10ME74

Seventh Semester B.E. Degree Examination, June/July 2015
Operations Research

Time: 3 hrs.

Max. Marks: 100

**Note: 1. Answer any FIVE full questions, selecting
atleast TWO questions from each part.
2. Use of statistical tables is permitted.**

PART - A

- 1** a. List and briefly explain the various phases of O.R. study and state the limitations of O.R. models. (10 Marks)
- b. The XYZ Company has been a producer of electronic circuits for Television sets and certain printed circuit boards for Radios. The company has decided to expand into full scale production and marketing of AM and AM - FM radios. It has built a new plant that can operate 48 hours per week. Production of an AM radio in the new plant will require 2 hours and production of AM. FM radio will require 3 hours. Each AM radio will contribute Rs 40 to profit, while an AM - FM radio will contribute Rs 80 to profits. The marketing department, after extensive research, has determined that a maximum of 15 AM radio, and 10 AM - FM radios can be sold each week. Formulate a L.P. model to determine the optimal production mix of AM and AM - FM radios that will maximize profits and solve the problem using Graphical method. (10 Marks)
- 2** a. Obtain the Dual problem of the following Primal problem
Min $Z = 2x_1 - 5x_2 - 2x_3$
Subject to $3x_1 - 1x_2 + 2x_3 \leq 9$
 $2x_1 - 4x_2 \geq 14$
 $-4x_1 + 3x_2 + 8x_3 = 12$
 $x_1, x_2 \geq 0$ and x_3 is unrestricted. (04 Marks)
- b. Use BIG - M method to solve the following LPP
Min $Z = 2x_1 + x_2$
Subject to $3x_1 + x_2 = 3$
 $4x_1 + 3x_2 \geq 6$
 $x_1 + 2x_2 \leq 3$
 $x_1, x_2 \geq 0$. (16 Marks)
- 3** a. The owner of a machine shop has four machines available to assign the jobs for the day. Five jobs are offered with the expected profit in ₹ for each machine on each job is as follows. Find the assignment of the machines to the jobs that will result in a maximum profit, which job to be declined. (10 Marks)

	A	B	C	D	E
1	62	78	50	101	82
2	71	84	61	73	59
3	87	92	111	71	81
4	48	64	87	77	80

- b. Solve the following Travelling, Salesman problem given by the following data $C_{12} = 20$, $C_{13} = 4$, $C_{14} = 10$, $C_{23} = 5$, $C_{34} = 6$, $C_{25} = 10$, $C_{35} = 6$, $C_{45} = 20$ when $C_{ij} = C_{ji}$ and C_{ij} value is not given, then there is no route between Cities i and j . (10 Marks)

- 4 a. List and briefly explain the methods of Integer programming problem. (06 Marks)
 b. Solve the following I.P.P.
 Max. $Z = x_1 + x_2$
 Subject to $3x_1 + 2x_2 \leq 12$
 $x_2 \leq 2$
 $x_1, x_2 \geq 0$ and integers. (14 Marks)

PART – B

- 5 a. A project consists of the following activities with their duration in days and the precedence relationship.

Activity	A	B	C	D	E	F	G	H	I
Precedence	-	A	A	B, C	A	D, E	C	F, G	H
Duration (days)	10	12	5	7	9	10	8	10	9

- i) Draw the network for the above information ii) Identify the critical path and duration
 iii) Calculate EST, EFT, LST, LFT, TF. (10 Marks)

- b. A project schedule has the following characteristics :

Activity	1-2	2-3	2-4	3-5	4-5	4-6	5-7	6-7	7-8	7-9	8-10	9-10
t_m	2	2	3	4	3	5	5	7	4	6	2	5
t_o	1	1	1	3	2	3	4	6	2	4	1	3
t_p	3	3	5	5	4	7	6	8	6	8	3	7

- i) Draw a project work, identify the critical path and its expected duration and variance.
 ii) What is the probability of completing the project in 30 day schedule time?
 iii) What due data has 90% chance of being met? (10 Marks)
- 6 a. Briefly explain characteristics of the Queuing system and classification of queuing models using KENDAL and LEE notations. (10 Marks)
 b. Arrivals at a Telephone booth are considered to be Poisson distribution at an average time of 8min between one arrival and the next. The length of the phone call is distributed exponentially with a mean of 4min. Determine
 i) Expected fraction of the day that the phone will be in use ii) Expected number of units in the queue
 iii) What is the probability that an arrival will have to wait more than 6min in queue for service? iv) What is the probability that more than 5 units are in the system? (10 Marks)

- 7 a. Define and briefly explain the following terms with respect to GAME theory.
 i) PURE STRATEGY ii) SADDLE POINT iii) VALUE OF GAME iv) TWO PERSON ZERO SUM GAME
 v) PAY – OFF. (10 Marks)
 b. Solve the following TWO PERSON ZERO SUM GAME by Graphical Method. (10 Marks)

		B				
		I	II	III	IV	V
A	1	-5	5	0	-1	8
	2	8	-4	-1	6	-5

- 8 a. When passing is not allowed, solve the following problem giving an optimal solution.

Machine (10 Marks)

	M ₁	M ₂	M ₃	M ₄	M ₅
A	9	7	4	5	11
B	8	8	6	7	12
C	7	6	7	8	10
D	10	5	5	4	8

- b. Find the sequence that minimized the total time required in performing the job on 3 machines in the order CBA.

Machine (10 Marks)

JOB	A	B	C
1	8	3	8
2	7	4	3
3	6	5	7
4	9	2	2
5	10	1	5
6	9	6	1

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10ME754

Seventh Semester B.E. Degree Examination, June/July 2015

Non Conventional Energy Sources

Time: 3 hrs.

Max. Marks:100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART – A

- 1 a. Briefly discuss the need of non-conventional energy sources for future power needs of the country. (10 Marks)
- b. Briefly discuss the solar energy options for supplying energy needs. (10 Marks)
- 2 a. Define following terms.
 - i) Solar constant I_{sc}
 - ii) Declination Angle δ
 - iii) Local solar time (LST)
 - iv) Zenith angle θ_z
 - v) Hour Angle w
 (10 Marks)
- b. Calculate the angle made by Beam Radiation with the normal to the flat plate collector pointing due south location in New Delhi ($28^\circ 38' N, 77^\circ 17'E$) at 9.00 hr. Solar time on December 1st. The collector is tilted at an angle of 36° with the Horizontal. Also find day length. (10 Marks)
- 3 a. Explain with a neat sketch working of a flat plate liquid collector, and any two standard panel radiators used for collectors. (10 Marks)
- b. With a neat sketch explain solar pond? List operational problems. (10 Marks)
- 4 a. Explain briefly the factors which affects the performance of flat plate liquid collectors. (10 Marks)
- b. The following data Refers to flat plate collector

$(\tau\alpha)_b = 0.727$ (Transmissivity – Absorptivity product for Beam Radiation)
 $(\tau\alpha)_d = 0.642$ (Transmissivity – Absorptivity product for Diffused Radiation)
 Length of plate = 1.5 m
 Width of the plate = 1m
 Intensity of beam Radiation = 665 W/m^2
 Intensity of Diffused Radiation = 230 W/m^2
 Tilt factor for Beam Radiation = 0.9384
 Tilt factor for Diffused Radiation = 0.9742
 Absorptivity of the plate = 0.95
 Absorptivity of the Glass = 0.88
 Collector Heat Removal factor = 0.866
 Overall loss coefficient = $4.5 \text{ W/m}^2\text{-k}$
 Water inlet Temperature = 60°
 Ambient Temperature = 25°C

Tilt factor for reflected radiation = 0.0052

Angle of incidence = 29.30°

Find :-

- i) Total solar flux incident on the collector
- ii) Incident flux absorbed by the absorber plate
- iii) Instantaneous efficiency

(10 Marks)

PART – B

- 5 a. Explain briefly any two types of Horizontal axis wind mills. (10 Marks)
b. Discuss briefly the major problems in Harnessing wind energy. (10 Marks)
- 6 a. With a neat sketch explain the working of double basin tidal power plant. What are advantages? (10 Marks)
b. Explain with a diagram vapour dominated Geo thermal power plant. List the operational problems. (10 Marks)
- 7 a. Discuss the factors which affect the Bio-gas production in a bio gas plant. (10 Marks)
b. What are the applications of Bio gas? Explain the modifications needed for CI engine using Bio-gas (10 Marks)
- 8 a. With a neat sketch explain the working principle of tank type Electrolyzer for Hydrogen production. (10 Marks)
b. Briefly discuss the methods of Hydrogen storage. (10 Marks)

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